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Cooper News
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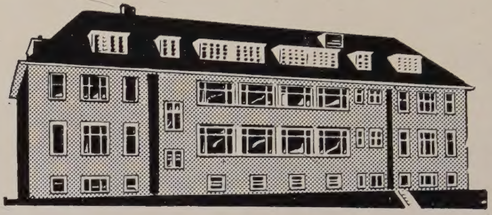

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This Month's Cover

This month's cover showing a pure-bred Large White sow and her litter has been reproduced from a colour photograph taken at the Wairarapa Training Farm, near Masterton. Practical 2-year courses which include pig husbandry are given at the farm to youths between the ages of 15 and 18. The property of 736 acres was purchased in 1918 from donations collected in the district to provide a training establishment for returned men of the First World War. It was used for a similar purpose after the Second World War, but later the farm was reorganised to serve as a training centre for youths.

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Value of Short-rotation Ryegrass in the Manawatu

DURING the last 10 years short-rotation ryegrass has been used on an ever-increasing scale in many parts of the country. In the Manawatu district with its fertile soil and adequate, evenly spread rainfall short-rotation ryegrass has been found to be valuable on both sheep and dairy farms. In this article J. A. Graham, Fields Instructor, Department of Agriculture, Palmerston North, describes its use and the effect it has had in increasing production on some Manawatu farms.

FROM trials by farmers and research workers a fairly clear picture of the sphere of usefulness of short-rotation ryegrass has emerged. Experience has shown that it has a very valuable place in permanent grassland farming, but certain features of this type of ryegrass must be stressed if many of the disappointments which have been experienced are to be avoided.

Short-rotation ryegrass does best where soil moisture is adequate. If the grass is to survive the summer and persist, the land should not dry out excessively in summer; also, the grass will not persist through really droughty conditions unless it is allowed to reseed.

Conditions for Best Production

This grass is a vigorous, leafy plant and demands high fertility for best production. It does well under conditions such as those required for good perennial ryegrass growth, but, like other high-producing grasses, it does not like wet or waterlogged soils. It will not thrive, or even survive, on poor country which will support only species demanding low fertility such as sweet vernal and browntop. Short-rotation ryegrass must have large supplies of nitrogen; it thus demands a strong sole of clover, and on soils deficient in nitrogen it will have an unthrifty appearance. Nitrogen may be adequate at the time of sowing, but if it is not replaced, it will be depleted quickly because of the high initial production of the grass. For this reason it is not uncommon to see young pastures of short-rotation ryegrass with the same yellow, unthrifty appearance that the species has when grown on poor, nitrogen-deficient soils. A typical example of this was seen recently at Linton, where a spring-sown pasture containing a high proportion of short-rotation ryegrass was suffering from nitrogen deficiency as a result of poor clover development. Nitro-lime was applied at 1cwt. per acre early in May and there was an immediate response, with an increase in herbage production of several hundred per cent. by the end of the month.

Growth Habits

Short-rotation ryegrass is more persistent than Italian ryegrass but less persistent than perennial ryegrass. Its persistency, however, depends not only on this inherent character of the plant, but also on the conditions under which it is grown and the treatment it receives after sowing. On poor, dry soils, it behaves little better than an annual, but under suitable conditions of fertility and moisture and given suitable management it is possible for it to be virtually permanent.

The growth habit of short-rotation ryegrass is such that it requires different grazing management from that for perennial ryegrass if it is to produce and persist. It has certain characteristics, such as a high crown and more erect growth, which render the plant less able than perennial ryegrass to stand close and continuous defoliation. If grazed too hard and continuously by stock, especially sheep, it is liable to be eaten out; it is thus much more suited to rotational grazing.

The most valuable features of short-rotation ryegrass for the New Zealand farmer are high yield during winter and early spring, palatability, and ability to reseed. Compared with that of perennial ryegrass its production is much higher in winter and early spring and lower in summer and autumn.

Role in Times of Feed Shortage

The stock carried on most farms in New Zealand is limited to the number that can be safely carried during the difficult late winter and early spring and is not related to the number that could be carried during periods of peak pasture growth. The growing of supplementary feed crops and the provision of fodder in the form of silage or hay certainly assists in carrying stock through winter or periods of drought, but the chief difficulty confronting farmers is the provision of grass feed from just before calving or lambing time until the flush of feed

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HEADING PHOTOGRAPH: By extensive use of short-rotation ryegrass in recent years production has been raised rapidly on many sheep and dairy farms in the Manawatu.

in late spring. September and October, in particular, are often critical months, as feed is frequently short through feed crops being past their best and because pasture growth may be retarded by cold snaps.

Much has been accomplished in recent years in bridging this gap in feed production, particularly in the North Island, by the encouragement of out-of-season grass growth and the conservation of pasture by the cold storage method. Dairy farmers in particular were quick to exploit the use of short-rotation ryegrass in overcoming this shortage of feed, and it is customary now for some seed of this grass to be included in mixtures when new pastures are sown down on dairy farms. It has not been so popular with sheep farmers, chiefly because they have not appreciated the need for proper management. However, there is a tendency toward a greater use of it on sheep farms in the Manawatu, where ewe troubles in spring are usually associated with a shortage of good feed before and after lambing.

Short-rotation ryegrass is very palatable and is greatly favoured by stock. The palatability of a species is influenced by various factors, but when compared under similar conditions this ryegrass is as palatable as Italian ryegrass and more palatable than perennial ryegrass. In fact it has been found that a proportion of short-rotation ryegrass included with perennial ryegrass in a mixture will raise the palatability of the pasture considerably.

The early spring growth of short-rotation ryegrass pastures enables them to be cut early for silage. They then make valuable recovery growth before the onset of hot, dry weather.

Uses in Manawatu

With the exception of the dry sand country near the coast and most of the hill country, much of the farmland in the Manawatu is very suitable for the successful growing of short-rotation ryegrass, and it is used extensively on high-producing farms throughout the district. One factor which tends to limit its use on many farms in the district is poor drainage, for it will not thrive under wet conditions; but as the other important pasture species are similarly affected, there is no doubt that better pastures would result if greater attention were paid to drainage when pastures are being renewed.

The vigorous initial establishment of short-rotation ryegrass and its resultant power to suppress weeds are two of its most valuable features. Left—Perennial ryegrass with vigorous weed growth. Right—Short-rotation ryegrass.

Two main uses of short-rotation ryegrass have developed in the Manawatu: First, as a constituent of permanent pastures, when it is included in mixtures at rates ranging from 5 to 20lb. per acre, the higher proportion being used on dairy farms, and second, as the main grass species in special-purpose pastures. Many high-producing dairy farmers, expert fat lamb producers, and successful stud sheep breeders are using short-rotation ryegrass for special-purpose pastures for winter and early spring growth with considerable success and there is no question as to its value in increasing livestock production.

High-production Dairy Farm

Dairy production has increased rapidly in recent years and much of this increase has been due to the use of short-rotation ryegrass in conjunction with conserved pasture growth and rationed grazing. There have been many cases of rapid increases in production and this is well illustrated in the case of a progressive farmer at Longburn.

When the farmer purchased the 78-acre property in 1945 it carried 35 cows and produced 8000lb. of butterfat the first season. Since then, by good farming methods, including the renewal of pastures and use of mainly short-rotation ryegrass, he has rapidly improved the farm, which this season carried 60 cows which produced 20,500lb. of butterfat.

The soil on the farm is Kairanga silt loam, which is naturally fertile and capable of maintaining first-class pasture. Despite this, the pastures were mainly of poor grasses, but had good white clover when the present owner took over the farm. He realised that every paddock needed regrassing and he embarked on a programme of renewal. To start he intended to renew only one paddock each year, but when he saw the value of good young pastures he speeded up the programme and has now renewed most of the pastures on the farm.

The first year he sowed perennial ryegrass with white clover, but he became interested in short-rotation ryegrass and the following year sowed a mixture of 50 per cent. of each ryegrass with the white clover. He was so impressed with the early growth of short-rotation ryegrass and its value in the control of bloat that he increased the quantity in the mixture and reduced the perennial ryegrass. At about the same time he introduced cowgrass and Montgomery red clover into the mixture at the rate of 3lb. of each per acre plus 3lb. of white clover. Later he was using short-rotation ryegrass alone with the same quantity of clovers, but he found that the sward tended to be too open when the perennial ryegrass was omitted, and is now using a mixture consisting of 1 part of perennial ryegrass to 2 of short-rotation ryegrass. The seeding rate of the red clovers has been reduced to 2lb. of each per acre.

He has generally sown the pastures in late autumn on areas which have grown crops of maize or turnips for summer feed. Now he proposes to reduce the area in summer crops and make silage, some of which will be used for summer feed if required. He believes in keeping his pastures young and vigorous and hopes to renew them at least every 5 years, so he will use the grass to grass method as well.

Bloat Control

One of the problems of high-producing dairy farms is the incidence of bloat. This is more frequently associated with good pastures in which the ratio of clover in the herbage is greater than that of the grass. Short-rotation ryegrass has proved to be invaluable in spring in giving some control over this complaint, because with its vigorous growth at that time, especially if it is allowed to grow fairly rank, it tends to dominate the clover. Unfortunately this period of usefulness does not extend into summer and autumn, when its growth is less vigorous, so other species such as cocksfoot are included in the pastures.

Fat Lamb Farm

When grown on reasonably fertile soil short-rotation ryegrass will persist and give good production for many years under sheep grazing, provided it is given proper management. A farmer near the Rangitikei River has had good results with this grass on his mixed fat lamb and cropping farm, and under his method of farming it will persist for 5 or more years. His methods are unusual for this part of the country and are more like those used in the arable areas of the South Island.

He usually sows his pastures on areas which have grown a crop of wheat the same season. His practice is to sow in late February or early March, and as soon as the wheat crops have been harvested he begins to prepare the seed-bed. This work is carried out thoroughly with particular emphasis on consolidation. As a grower of Certified seeds he always sows the higher grades, and his seeds mixture per acre consists of 30lb. of Government stock or Pedigree short-rotation ryegrass, 3lb. of Pedigree white clover, and 1½ bushels of N.I.A.B. ryecorn. The ryecorn is included because the farmer believes that by growing it with the grass he obtains greater feed production during the first few months, particularly during winter. This enables him to carry an increased number of stock on the areas, thus increasing fertility, particularly in nitrogen, which in turn raises the production of feed and seed from the short-rotation ryegrass.

The ryecorn is drilled in, the ground is then rolled, and the grass seed broadcast after the rolling. The farmer sows 1½cwt. of superphosphate with the seed and topdresses the area with 1½cwt. of superphosphate in spring. In addition, 1 ton of lime is applied to the pastures every 5 years.

The young pastures are grazed as soon as the roots of the ryegrass have developed to the stage when the young plants cannot be readily pulled out of the ground—usually after 3 to 4 weeks. The areas are rotationally grazed with 40 to 50 sheep per acre, the stock being on for 1 week and off for 1 week. The recovery of the ryecorn from the grazing is very similar to that of the grass, and because of the early start the pasture has received, plus the heavy return of nitrogen, the farmer is able to maintain the grazing procedure throughout winter with adjustments to the number of sheep per acre. The pastures are set-stocked with 7 ewes and their lambs per acre from September until the middle of December, when the first draft of fat lambs is taken; the areas are then rotationally grazed again. A greater number of ewes than this could be carried per acre, but the farmer has found that with a greater number the lambs do not do so well, so cattle are used to control the surplus growth.

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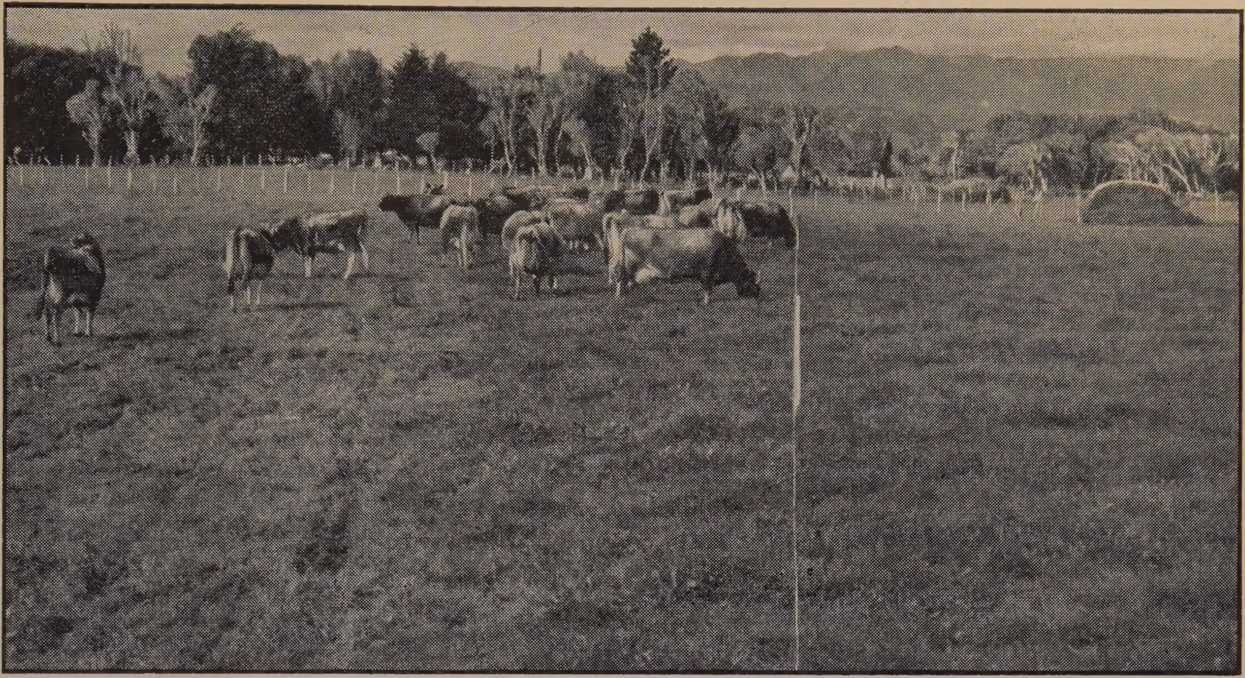
Perennial ryegrass is also grown on the farm, but short-rotation ryegrass is preferred because it gives good production at the times when it is most required by the fat lamb producer. The carrying capacity of this farm has increased considerably by use of the methods described, but the number of sheep carried fluctuates from year to year as the pastures are used for fat lamb production, beef production, hay, or grass seed as the circumstances warrant.

Stud Sheep Farm

In the rearing of stud sheep, particularly young stock, it is important that there should be a continuous supply of good-quality, palatable feed which will not cause upsets to the animals. Short-rotation ryegrass has given good results in this respect and is used by many successful stud sheep farmers in the Manawatu as a special-purpose pasture alone or as a constituent of permanent pastures. A prominent breeder in the Kiwitea district has had particularly good results by including this grass in his pastures and has found it excellent for the rearing of hoggets. It has proved much safer than perennial ryegrass for stud hoggets in autumn, because the perennial ryegrass tends to produce soft, lush feed at this period which causes scouring. Short-rotation ryegrass is also valued on this farm because of its good growth of palatable, high-quality feed in late winter and early spring.

The methods of establishing pasture and provision of feed on this farm are as follows: In spring of each year an area is sown in oats and tares to provide summer feed for the sheep until March, when the area is cultivated and sown down to pasture. The grass to grass method has also been used, but this has not proved so successful. The seed mixture used per acre consists of 10lb. of short-rotation ryegrass, 10lb. of perennial ryegrass, 4lb. of cocksfoot, 2lb. of timothy, 5lb. of white clover, 2lb. of Montgomery red clover, 3lb. of cowgrass, and 1lb. of subterranean clover, plus 1 bushel of oats and 1 bushel of tares. Perennial ryegrass is included because it gives the pasture a better bottom and so keeps out weeds, and the cocksfoot is included because it will grow during dry weather and provide roughage for the stock.

The young pastures are grazed as soon as the oats are ready for grazing and are rotationally grazed until spring. Seasonal conditions govern the subsequent treatment. Sometimes they are rotationally grazed and sometimes they are set-stocked. Young pastures up to 3 years of age are reserved solely for hoggets. Cattle and the mower are used to control surplus growth, particularly to prevent the cocksfoot becoming too rank, and the pastures are never allowed to run to seed. The pastures on this farm are undoubtedly good as a result of the



Short-rotation ryegrass will not stand hard, continuous grazing. It is of most value under a system of rationed grazing with the electric fence.

management which they receive plus the liberal use of superphosphate and lime.

General Uses

Hay and Silage

In addition to its value for grazing, short-rotation ryegrass also produces high yields of first-class hay and silage. The hay, in particular, is very palatable and is preferred by stock to that of perennial ryegrass. Because of the earlier spring growth of short-rotation ryegrass the stage where there is an excess of spring pasture growth is reached much earlier on farms where it is used than on those depending on perennial ryegrass alone. This enables the farmer to shut up areas for silage and hay earlier in the season, thus obtaining better yields. In addition, the crops, especially silage, can be harvested earlier, allowing the pastures time to recover and make good growth before the onset of hot, dry weather.

Seed Production

Climatic conditions tend to affect the yield of short-rotation ryegrass seed in the district, for it sheds seed very easily, but in suitable seasons yields of 35 to 40 bushels per acre have been recorded, with second crops of up to 35 bushels. Care has to be used in harvesting the seed of this grass, for it is very subject to heating in the bag.

Establishment and Management

Most pastures in the Manawatu are sown in autumn and best results are obtained when sowing takes place early on a well-prepared seed-bed. Conditions are sometimes dry at this time, but if the cultivation has been thorough, good strikes usually follow. A cloddy seed-bed leaves open spaces below the surface, preventing moisture from rising to the top and germinating the seed, which is usually broadcast on the surface. It is important, therefore, that the seed-bed should be well compacted from the bottom upward, with a shallow tilth on the surface to cover the seed. Neglect of this factor is often the reason for the poor establishment of pastures in the district and is a possible explanation for the high quantities of seed which are sometimes sown per acre.

With a good seed-bed short-rotation ryegrass will establish rapidly and has the necessary vigour to give quick feed and suppress weed growth. Unfortunately, clovers can be suppressed in the same way as the weeds, and unless care is exercised, this grass will also choke out the clovers. Frequent quick grazing by sheep or young dairy stock will allow the clovers to compete with the ryegrass, but this is sometimes difficult in wet weather because of the risk of damaging the young pastures by poaching. There is an increasing tendency in the district to include a cereal when sowing down to assist the prevention of poaching as well as provide additional winter feed. Care should be taken with the subsequent grazing of short-rotation ryegrass, for experience has shown that it can be easily eaten out under hard grazing. The best results have been obtained when it is leniently and rotationally grazed.

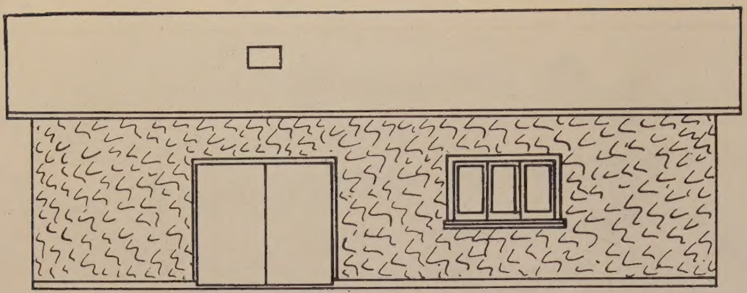
As has been stressed previously, short-rotation ryegrass has a heavy nitrogen requirement and the best means of supplying this is by use of clovers. It is particularly important, therefore, that clovers should be encouraged to develop as soon as possible, and the application of phosphatic fertilisers and lime should not be neglected where these are required. Red clover competes better with the grass during the early life of the pasture, and apart from its value in providing feed when growth of grass tends to be backward in summer and autumn, it should be included in mixtures to supply nitrogen until the white clover fully develops.

The main disadvantages of short-rotation ryegrass are that it is non-productive in hot, dry weather, and is subject to severe mortality under these conditions as well as under the normal management which many pastures receive on New Zealand farms. It is also slightly more susceptible to grass-grub damage than perennial ryegrass and definitely more so than cocksfoot, which has a more vigorous root development, but it has also very good powers of regeneration from shed seed. This characteristic was well demonstrated after the Manawatu floods last summer, when paddocks which had been shut up for hay or seed crops recovered very rapidly from seed shed by the short-rotation ryegrass.

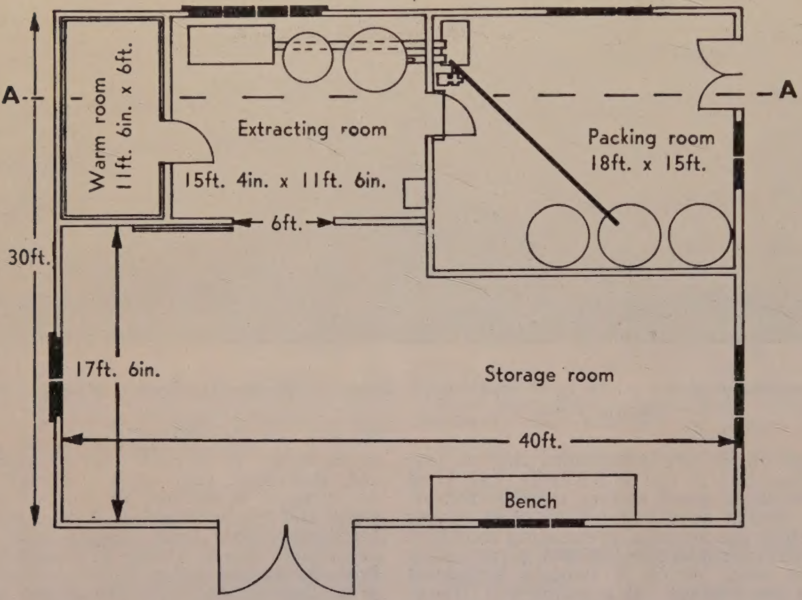
This grass has proved to be valuable for the Manawatu, and where soil and management conditions are suitable it can with advantage replace a portion of the perennial ryegrass. It has a definite place on the more fertile soils of the district, which are well drained in winter yet moist in summer, and its use might well be extended in these areas.

Honey House Construction and Layout

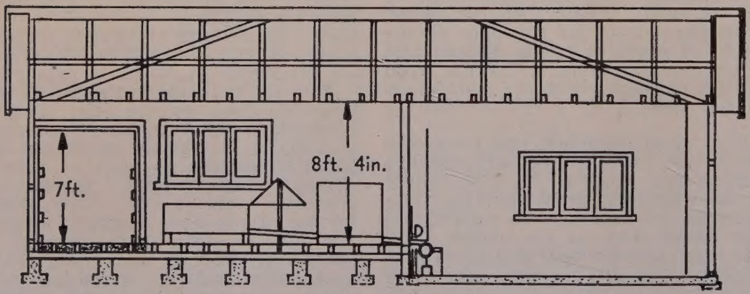
Plan No. 3 of Honey House



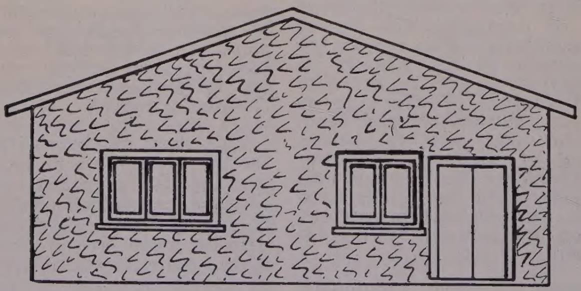
Front Elevation



Plan



Section AA



End Elevation

A FEATURE of beekeeping in New Zealand is the desire of producers for development and installation of up-to-date labour-saving apiary and honey house equipment. This cannot be accomplished successfully unless the beekeeper has in addition to healthy stocks of bees a well-constructed and well-laid-out honey house with adequate storage room in which to extract and pack a crop of honey in first-class order under hygienic conditions. In this the second of a series of three articles on honey house design and layout of plant L. H. Johnson, Apiary Instructor, Department of Agriculture, Palmerston North, provides further information as a guide to the erection of buildings that will give good performance according to the requirements of individual beekeepers. From this information plans incorporating whatever suggested features are desired may be drafted for submission to a local body for building permits.

THE site, the surroundings, and the direction of approach must be considered before the design of a honey house is decided on. Should a plan be ideal except that the layout is the reverse of that suited to the section, its possibilities in reverse may be appreciated simply by viewing it through the paper. Two plans were discussed in the first article in this series published last month.

Plan No. 3

Plan No. 3, which is suitable for a level section where the building may face the road and where the residence is to the right of it, allows for the arrangement of all the different compartments under one roof.

Floors: The floors of the packing room and storage room are of concrete. A concrete foundation wall to stand 4in. above the floors should surround the storage and packing rooms. Concrete piles 4ft. apart each way will carry the wooden floor in the extracting room.

Framework: The frame of the building may be 4in. x 2in. timber with diagonal bracing and dwangs. Ceiling joists should first be spiked together to form a tie beam across the building; then they may be fixed to the sides of each alternate pair of rafters and strutted vertically and diagonally to form a roof truss. A runner may be fixed across the underside of the rafters midway between the ridge and the plate to carry the alternate pairs of rafters.

The outside walls may be covered with building paper, wire netting, and stucco. When the walls have dried out they should be done over with near-white cement paint. The roof may first be covered with wire netting and waterproofed paper and then with corrugated iron or aluminium.

Inside lining: The walls and ceiling of the extracting and packing rooms should be lined with wallboard and wood pulp soft board. The Food Hygiene Regulations 1952 specify that walls and ceilings should be painted. There does not appear to be a better covering for wood pulp board than one of the modern plastic paints. Each room lined with wallboard should have a skirting board fixed to the walls. The storeroom is not lined.

Lighting: Windows as shown on the plan should provide sufficient lighting. A skylight above the truck dock is necessary.

Extracting room: The floor at 1ft. 8in. above the concrete allows for reasonably easy unloading of a truck and at the other end provides sufficient drop for honey from the extractor to flow through a chute into a small tank with a strainer in the packing room, whence it may be pumped to the tanks.

With the uncapping melter, comb turntable, and extractor lined along the wall there is no waste floor space.

An electrically heated hot water cylinder and a washhand basin should be handy and yet out of the way if set up on the wall.

Drainage: This is important, particularly if the section is level. Where it is possible to connect with a local body sewerage system there is no problem other than cost. A closed drain and septic tank should be satisfactory. Surface drainage should be provided if necessary, as it is desirable that a honey house and surroundings should be dry.

Warming room: There is sufficient floor space to allow for a warming room to be built at one end. This room must be completely insulated to be satisfactory. Before the floor is laid flooring should be cut in between the joists and made thoroughly vermin proof. This space, which may be 3in. or more deep, should be filled with dry (timber) planer chips. To prevent any water getting through, impregnated paper should be laid over the joists. The usual type of tongued and grooved flooring may then be laid and fixed. The walls, ceiling, and door should be covered with wood pulp soft board. Better insulation is obtained if the room is double lined with the soft board. It is also advisable to fix 3in. x 1in. battens horizontally around the walls at 1ft. spacings up to a height of 4ft. to protect the soft board. The door will require heavy hinges and a latch that will keep it shut under pressure. Whatever type of latch is used a person should be able to open it from the inside.

Packing room: The honey pump, counter shafting, and pulleys may be fixed to the wall, thus saving floor space.

While extracting is in progress it is easy to keep an eye on the honey levels in the small strainer tank and the main tanks.

Windows on two walls should admit adequate daylight.

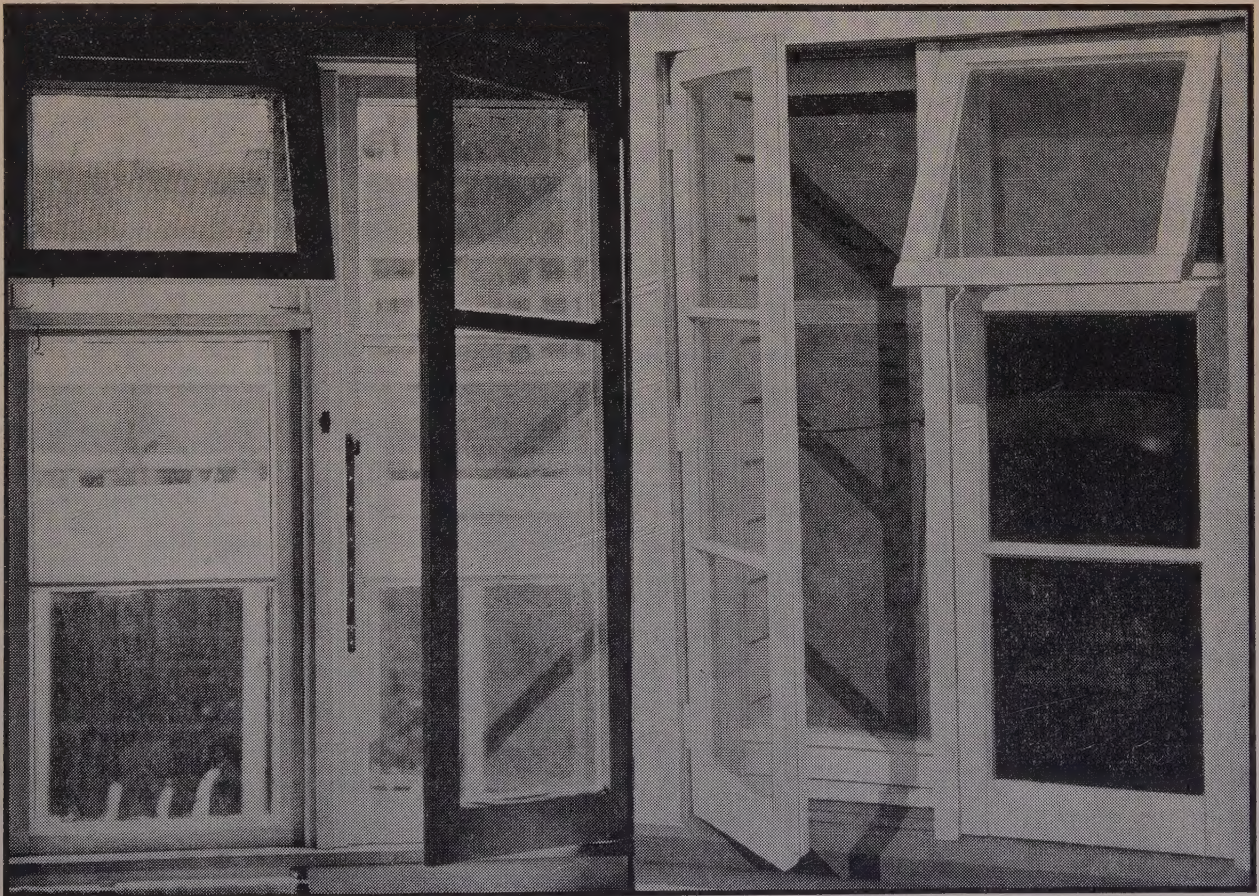
Packed honey may be loaded on to a truck on the outside of the building or may be carried through the packing room to the truck.

Room for storage: The large room is for housing the truck, storing boxes with bee combs, and space for a workshop. Empty honey tins and cartons may be stored above the ceiling. A skylight above the truck dock will admit daylight where it is needed.

Plan No. 4

Plan No. 4 is designed for the minimum of space. If an extension was needed, the front wall of the packing room could be brought forward and the room added to. The main feature is that the floors of the extracting and packing rooms are built 3ft. above the garage floor so that unloading or loading of a truck may be done with some type of trolley.

Foundation: The garage floor should be of concrete 4in. thick with foundation walls extending 4in. above the floor. Because of the heavy floor loading piles require to be set closer together than for the ordinary type of building. Rows of piles must be spaced (within limits) according to the width of the building. Each row should be approximately 4ft. apart and at 4ft. centres in the row. Piles 8in. x 8in.



Screened windows for honey houses. Left—Window from inside with sash closed and screen open. Right—Outside view with sash open and screen closed.

should have bases 12in. x 12in. x 4in. Each pile on the outside walls should be reinforced with one steel rod of not less than ⅜in. diameter. Bulk containers of honey in a stack 10ft. x 10ft. x 7ft. weigh over 20 tons. This loading with the usual spacing of piles at 6ft. x 4ft. may be more than some types of soil will stand without settlement. Sleeper plates may be 4in. x 3in., floor joists 5in. x 2in., and flooring of tongued and grooved timber 1in. thick.

The usual type of framing, roof, ceilings, and inside wall coverings as previously specified should be used. For the outside walls 6in. x 1in. bevelled-back weatherboarding should make a good job. Casement windows and one pair of adjustable louvres should provide adequate light and ventilation. Electric lighting should also be installed.

Facilities: In the extracting room are a washhand basin with hot and cold water and a small cloak room. The minimum of extracting plant is shown on the plan. Wherever possible it is as well to place the extractor some distance away from a window, as the light will attract bees away from the machine.

Heavy Lifting Avoided

With the floor level at the same height as the deck of a truck supers of honey may be unloaded from the vehicle by a hand truck or bogie and wheeled to any part of the extracting room. Honey must be elevated to the honey tanks by a honey pump. Packed honey may also be wheel borne on to the motor truck.

Access to the building is through the packing room. If the front of the building faces the prevailing wind, it may be wise to build a porch over it. A tank may be set up to catch rain-water from the roof, as rain-water is soft and this type of water is best for the beeswax rendering process.

Bee Comb Storage Shed

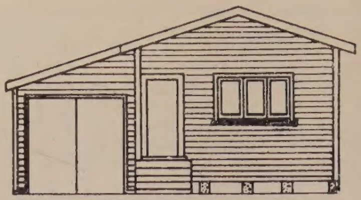
Bee combs should, if possible, be stored in a separate building for the following reasons:—

1. They are a fire hazard. Supers with bee combs are so combustible that it would be almost impossible to save the premises if a fire started among them.

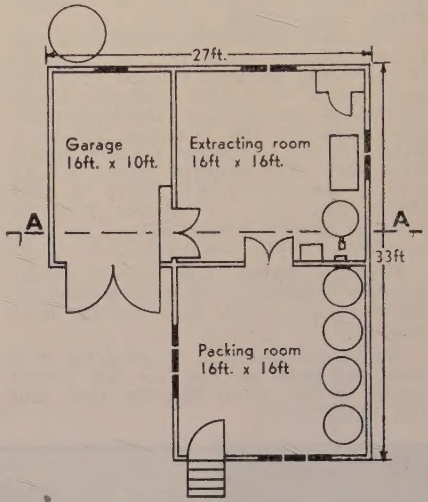
2. A special design of building that will be vermin proof, dry, draughty, and exclude sunlight is desirable.

3. In a separate building bee combs can be fumigated with poisonous gases without endangering human life.

Plan No. 4 of Honey House

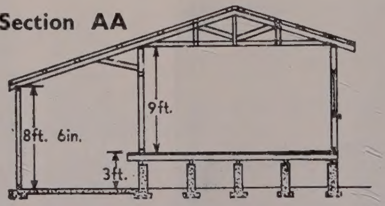


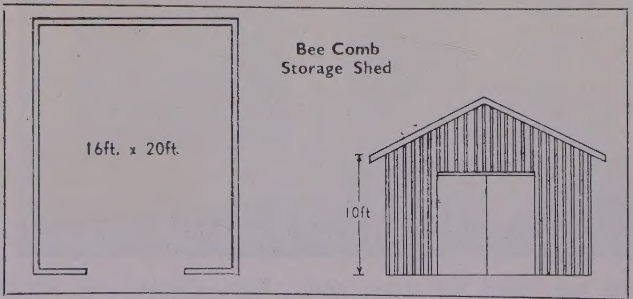
Front Elevation



Plan

Section AA





Size of building: The first consideration is the size of building for the storage of approximately 1200 supers with bee combs. A building with 320 sq. ft. of floor space and a 10ft. stud meets this requirement.

Building specification: The floor should be of concrete 3in. thick with foundation walls. Timber framing for walls and roof should be 4in. x 2in. Bottom plates should be set on a damp course and bolted to the foundation walls. Studs may be fixed at 2ft. 6in. centres. Each wall should be braced and have three rows of dwangs cut in between the studs.

Collar ties of 6in. x 1in. timber and three tie beams of 4in. x 2in. should be fixed to each alternate pair of rafters.

Walls should be sheathed with 9in. x 1in. sawn timber fixed vertically, with planks 1in. apart.

Wire netting should be stretched over the purlins and covered with impregnated, waterproofed paper. Corrugated iron or aluminium sheets can be used over this. To keep out birds or vermin the spaces between the vertical boards should be covered on the inside with fine mesh wire netting. Two doors each 7ft. high and 4ft. wide should be provided.

If the timber has not been preserved, the outer face of the wall framing and the inner sides of the boards should be coated with some timber preservative. A coal tar preparation is not recommended for this or any other building where bee combs are stored or honey is extracted.

Grazing Lucerne in Otago

THE area of lucerne grown in Otago has more than doubled since 1939. In many of the drier parts of Otago it is used alone or in mixtures for grazing without being cut for hay or silage, and on many properties the possibility of regular cutting is not considered. It can be sown in spring, summer, and autumn, but late summer and autumn sowings are best, as weeds may be troublesome earlier.

For good establishment of lucerne a firm seed-bed which has previously been well fallowed is essential, and for a good coverage of plants broadcasting on to a rolled surface is the best method of establishment. Where the surface tends to dry out better results will be obtained by drilling on to a rolled surface. For January sowings soft turnips for early spring feeding can be mixed with the lucerne at 8oz. to 10oz. per acre. For late February-early March sowings lucerne can be sown with cereal greenfeed. This is usually carried out by harrowing and rolling after the greenfeed has been drilled and broadcasting or lightly drilling the lucerne on to the rolled surface.

Established stands or even young stands become consolidated after feeding off and a hard surface develops. Cultivation with a suitable type of harrow should be carried out whenever the surface becomes sealed, as this allows rainfall to soak in rather than run off. More drastic treatment is necessary for older stands which have been invaded by grass, and the stiff-tined grubber can be employed here. Cultivation can be carried out during the non-growing season when weather and surface conditions permit, either in early spring before growth begins or in late autumn. Because of its strong rooting habit lucerne is one of the few crops which can stand up to severe treatment of this nature. Where it is required for grazing lucerne sown alone or with 2lb. to 3lb. of cocksfoot will provide good fattening feed on many non-irrigated areas where the more widely used grasses and clovers produce little or no feed during summer and early autumn.

—W. A. LUNN,
Fields Instructor,
Department of Agriculture,
Dunedin

Fertilisers in the Market Garden Programme

By JEAN G. MILLER, Biometrician, Department of Agriculture, Wellington, and H. A. BROWNING, Research Officer, Department of Agriculture Rukuhia Soil Research Station

MARKET garden crops in districts near Auckland are commonly given heavy dressings of phosphatic and nitrogenous manures in the belief that these are essential for a good yield of produce when market prices are most favourable.

THE organic manures such as dried blood, blood and bone, and bonedust are the most favoured, but the cost of these is sometimes high and their supply is usually limited. It may not be in the best interests of the country that all the available quantities of these materials should be diverted to market garden crops unless the responses are outstanding.

A long-term trial on Hamilton clay loam has shown, over the first 3 years, no outstanding superiority of organic forms of phosphate or nitrogen over inorganic forms on that soil type, but has shown that high dressings of organic or inorganic phosphate are almost always payable.

Trial at Hamilton

In 1949 a trial planned to run for 9 years was begun at the Department of Agriculture Rukuhia Soil Research Station to measure the responses to rates and forms of phosphatic and nitrogenous manures on a range of crops in a typical market garden rotation. The trial was on sloping ground on Hamilton clay loam, a soil on which pasture usually responds to phosphate and sometimes to nitrogen. This soil type is similar to those found at Pukekohe, Patumahoe, and Bombay, which are extensive vegetable growing areas. The area was prepared from old pastures which had received no manure for a long time. The rotation of the crops was:—

1st year: Potatoes, Succession cabbage.

2nd year: French beans, spring cabbage.

3rd year: Silver beet, lupins (green manure).

Three separate blocks were used so that the beginning of the rotation could be staggered. In the first year one block was sown to potatoes, one to french beans, and one to silver beet. Thus each vegetable will be grown in some part of the trial in each year, and when the trial has been completed in 9 years all plots will have been through the rotation three times. Because each plot receives the same fertiliser application with each crop as it did at the beginning of the trial, it will be possible to measure the cumulative effect of each manure on each of the different crops. One cycle of 3 years has now been completed.

Treatments Tested

Nitrate of soda at 1cwt. and 5cwt. per acre was applied and the responses were compared with those of dried blood applied at rates to give equivalent nitrogen. Superphosphate was also applied at 3cwt. and 10cwt. per acre, and the results of this were compared with those given by bonedust applied at rates to give equivalent phosphate. Thus the results of organic and inorganic forms of nitrogen and phosphate at two rates of application were each compared. Each rate and form of nitrogen was combined with each rate and form of phosphate. The fertilisers were applied at these rates to all crops except lupins and french beans, which received no nitrogen treatments. The placement of fertilisers was as follows, both forms of phosphate (P) and of nitrogen (N) being treated similarly:—

Potatoes: Seed planted on flat; P broadcast at planting, later moulded over rows; N in bands on tops of rows.

Planted crops: Half P in bands at sides of plants, half broadcast; N in ring around each plant on surface.

Green manure: Seed drilled; fertiliser broadcast.

French beans: Half in rows below seed and half broadcast.

All 5cwt. dressings of nitrate of soda were applied in two dressings, half at sowing and the remainder later. All crops had the usual fungicides, insecticides, etc., applied, and sodium molybdate was sprayed on to cabbages showing signs of whiptail.

HEADING PHOTOGRAPH: A general view of the market garden trial. Potatoes are in the foreground, beans are in the centre, and silver beet is in the background.

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It may be considered that some of the crops harvested show yields that are too low to be a payable proposition for a commercial market garden. Such crops must always occur from time to time as a result of the weather or other factors beyond control and are in no way related to fertiliser effects. On market gardens these crops are for the most part ploughed in without harvesting, but for trial purposes a continuity of data is required and all crops are harvested at maturity and the yields tabulated whether they would be a payable commercial proposition or not.

As a result of this practice a somewhat smaller than normal quantity of plant residues is ploughed in and catch crops are not taken. When winter cabbage is harvested the land is without a crop from June tc the end of October. It is then planted to beans, which are followed by a crop of barley to conserve fertiliser residue and to prevent erosion of the soil by heavy winter rains. This crop received no fertiliser and was ploughed in.

Results in the First Cycle of 3 Years

Potatoes

The outstanding result on the potato crop was the consistent yield response to 10cwt. of phosphate, of either kind, compared with 3cwt. Average yields for the 3 years are shown in the following table:—

Crop	Tons per acre
1950	11.0
1951	8.8
1952	9.6
3 years' average	9.8

The average responses to the higher rate of phosphate were:—

Crop	Tons per acre
1950	1.8
1951	1.5
1952	0.9
3 years' average	1.4

These responses make the use of 10cwt. of phosphate worth while on this soil type, at least on land that has not had heavy manuring before. Higher rates may result in even further increases, though this trial can provide no evidence either for or against that theory. The yields of the potatoes were reasonably consistent from year to year, though seasonal differences were greater than those from fertiliser effect.

Silver Beet

The silver beet showed the most pronounced response from the high rate of phosphate, but in the 1951 crop the high rate of nitrogen gave an increase also, the inorganic form, nitrate of soda, being better than the organic form, dried blood. Average yields and responses are shown in the following table:—

Crop	Average yield	Response to 10cwt. phosphate	Response to 5cwt. nitrogen
	tons per acre	tons per acre	tons per acre
1949	13.2	Small	Nil
1950	16.0	1.7	1.0
1951	20.3	3.1	2.9
3 years' average	16.5	1.8	1.3

The difference in yield in favour of nitrate of soda at 5cwt. per acre compared with dried blood at equivalent rates in 1951 was 2.2 tons per acre. This difference in the results obtained from the two forms of nitrogen appeared only at the high rate of application.

The variations in yield between seasons may be due to the fact that this crop is grown from late September to late December. This is unusual for the district, where it is mostly harvested in early spring. Hot, dry weather in December can cause a drop in yield.

French Beans

Results with french beans have not been consistent over the 3 years. However, there is slight evidence that bonedust, though beginning with slightly lower yields than superphosphate, has been improving its position each year, and may be slightly better than superphosphate in later years. No conclusions about this effect should, however, be drawn until results for the next 2 years are available. This effect was more pronounced on the results of the first picking and if this trend continues, it will be important, as the first picking is the most valuable. There was no indication that any other rate or form of fertiliser permitted an earlier picking than the rest.

RESPONSES TO PHOSPHATE AND NITROGEN—FRENCH BEANS

Crop	Mean yield at first picking	Response to high P	Response to high N	Mean total yield	Response to high P	Response to high N
	tons per acre	tons per acre	tons per acre	tons per acre	tons per acre	tons per acre
1949	9.3	2.4	1.0	15.4	1.1	0.3
1950	5.8	1.5	1.6	8.4	1.0	1.1
1951	5.4	1.7	0.7	9.6	0.9	0.3

This crop also is variable from year to year.

Enfield Market Cabbages

It is important that Enfield Market cabbages should mature as early as possible, and the high rates of phosphate and nitrogen produced increases in the yield of the early harvests. In one season the inorganic phosphate, superphosphate, was markedly better for first pickings than the organic bonedust, but in the other two seasons it was only slightly better. Because phosphate was the most important factor in yield, the small amount of phosphate contained in dried blood—which in this trial was applied mainly as a source of nitrogen—enabled it to do better than the inorganic form of nitrogen, that is, nitrate of soda, on some plots. However, on the plots which received adequate quick-acting phosphate in the form of superphosphate the nitrate of soda gave slightly better yields than the dried blood.

The effects of fertilisers on total crop weights were similar to those discussed above for the first pickings, but of smaller size. Unfortunately in the second year 70 per cent. of the crop was harvested at the first picking and this meant that any "earliness" effects would be missed. Mean yields and responses were as follows:—

COMPARISON OF YIELDS FROM SUPERPHOSPHATE AND BONEDUST—ENFIELD MARKET CABBAGES

Crop	Average yield at first picking	Diff. between superphosphate and bonedust	Total yield	Diff. between superphosphate and bonedust
	lb. per acre	lb. per acre	lb. per acre	lb. per acre
1950	1,200	+400*	15,600	+2,500*
1951	4,800	+800*	23,700	Nil
1952	1,000	—100	12,200	—500

* Plus difference means superphosphate gave better yields than bonedust.

Succession Cabbages

The high rate of phosphate applications has given increases in yield of Succession cabbages throughout the trial, more especially in the second year. There is a suggestion that a response to the high rate of nitrogen is gradually becoming apparent through a build-up of nitrogen content in the plots, but this is not yet definite. There were no differences due to different forms of nitrogen or phosphate.

With this crop there was no advantage to be gained from supplying the early market, so only one main picking was made.

A general view showing the nature of the slope on which the trial is located. Soil of this type is widely used for market gardening in the Auckland district.

Average yields were as follows:—

Crop		Average yield tons per acre	Response to high phosphate tons per acre
1950	.. ..	22.2	1.9
1951	.. ..	25.6	3.3
1952	.. ..	29.4	2.1

There was less seasonal variation in this crop than in some of the others.

Effects of Each Fertiliser on All Crops Together

These results may be summarised for each fertiliser by taking all crops together.

(a) **High rate of phosphate versus low rate:** For all types of crop at some time phosphate at 10cwt. per acre gave marked increases over phosphate at 3cwt. per acre. Average yields and responses to the high rate of phosphate were as follows:—

	Average yield	Response to high phosphate	Percentage response
	tons	tons	
Potatoes	9.8	1.4	14
Silver beet ..	16.6	1.8	11
French beans ..	7.7	0.3	4
Enfield cabbage ..	11.1	1.0	9
Succession cabbage	25.7	2.4	9

(b) **Bonedust versus superphosphate:** For french beans in the first 2 years superphosphate was superior to bonedust, but there were signs that this effect might be reversed in future. For Enfield Market cabbage in 1 year superphosphate gave earlier and better yields than bonedust.

However, on the whole, there were no differences between the results from the organic and inorganic forms of phosphate.

(c) **High rate of nitrogenous fertiliser versus low rate:** In the first years the high rate gave no better yields than the low rate. In the third year responses were obtained on Enfield Market cabbages, silver beet, Succession cabbages, and the first picking of french beans. Future results on this comparison will thus be particularly interesting.

(d) **Dried blood versus nitrate of soda:** Twice nitrate of soda gave better yields than blood, once on Enfield Market cabbages and once on silver beet. Otherwise there was no difference.

Thus a high rate of phosphatic fertiliser, at least up to 10cwt., would be payable for at least 3 years on crops such as those grown in this trial under similar soil and climatic conditions. It is too early yet to say whether this rate, if applied regularly, would eventually provide sufficient reserves of phosphate in the soil to enable good crops to be taken without further applications. This trial can provide no evidence on whether 10cwt. per acre is the maximum rate from which a payable response may be expected. Very much heavier rates than those used in this trial, up to 1 ton per acre per crop, are commonly applied in the district. As much as 4 tons per acre have been sometimes used.

Sometimes superphosphate, the quicker acting form of phosphate, gave slightly better results than bonedust and at other times there was no difference.

Responses to high rates of nitrogen were unreliable and though they sometimes proved payable, the evidence from this trial to date would not justify any recommendation for their general use on this soil type.

If nitrogenous fertilisers are used, nitrate of soda is to be slightly preferred to dried blood at the equivalent rate of nitrogen.

If any of the fertilisers are having an effect on soil structure, this would not be observed during the first 3 years. Hence all results reported here must be taken as indications only of the differences between forms and rates of fertiliser. The trial is being carried on for a further 6 years to test long-term effects.

Radio Broadcasts for Farmers

RADIO broadcasts to farmers will be given during July as follows:—

1YA Auckland, 7.15 p.m.

7 July—"Control of Tuberculosis in Cattle", by I. Davison, Veterinarian, Department of Agriculture, Auckland.

14 July—"Spring Crops for the Auckland Province", by H. Woodyear-Smith, Auckland.

21 July—"Winter Work in the Flower Garden", by M. J. Lockie, Horticultural Instructor, Department of Agriculture, Auckland.

28 July—Y.F.C. talk, by Kaitaia district committee, Federation of Young Farmers' Clubs.

1XH Hamilton, 8 p.m.

1 July—"Sleepy Sickness and Milk Fever in Ewes", by D. W. Caldwell, Veterinarian, Department of Agriculture, Hamilton.

8 July—"Pasture Experiments in Raglan County", by H. M. Bull, Instructor in Agriculture, Department of Agriculture, Hamilton.

15 July—"The Danger to our Dairy Industry of a High Cost Structure", by W. Petersen, Federated Farmers, Hamilton.

22 July—"Trace Elements", by E. B. Davies, Department of Agriculture's Soil Research Station, Rukuhia.

29 July—"Poultry Management", by W. L. Jourdain, Poultry Instructor, Department of Agriculture, Hamilton.

1YZ Rotorua, 7.15 p.m.

8 July—"Cropping in the Bay of Plenty", by A. V. Allo, Instructor in Agriculture, Department of Agriculture, Tauranga.

22 July—"Quality Faults in Milk and Cream", by J. B. Cockerton, Special Inspector, Department of Agriculture, Hamilton.

2XA Wanganui, 8 p.m.

1 July—"For the Countrywoman", by M. MacDonald.

8 July—"Radio Vet.", by S. Jamieson, Veterinarian, Wanganui.

15 July—"How to Avoid Most of the Deaths among Spring Born Pigs", by C. M. Bailey, Supervisor, Taranaki District Pig Council.

22 July—"Preparation for Shearing", by J. Ball, Sheep and Wool Instructor, Department of Agriculture, Wanganui.

29 July—"Weed Control on the Farm", by G. R. Moss, Fields Instructor, Department of Agriculture, Wanganui.

2YZ Napier, 7.10 p.m.

6 July—"Importance of Lucerne in Hawkes Bay", by A. J. Coughlan, Fields Instructor, Department of Agriculture, Napier.

20 July—"Grading of Meat for Local Consumption", by J. H. Thornton, Supervising Meat Inspector, Department of Agriculture, Napier.

2ZA Palmerston North, 12.30 p.m.

5 July—"Lambs Need Attention", by H. O. Mackley, Livestock Instructor, Department of Agriculture, Feilding.

12 July—"Place of Molybdenum on Wellington Hill Country", by J. M. Hopkins, Instructor in Agriculture, Department of Agriculture, Levin.

19 July—"Planting and Pruning Fruit Trees", by T. N. Flint, Plant Quarantine Officer, Department of Agriculture, Palmerston North.

26 July—Y.F.C. session, conducted by I. G. Tabor.

4YA Dunedin, 9.15 p.m.

7 July—"Ailments of the Dairy Herd", by J. Milne, Veterinarian, Department of Agriculture, Dunedin.

14 July—"Extension Division Engineering Section", by Machinery Instructor, Department of Agriculture, Dunedin.

28 July—"Crop Trials at Invermay", by J. N. Fitzgerald, Research Officer, Department of Agriculture's Research Station, Invermay.

4YZ Invercargill, 7 p.m.

6 July—"Soil Testing", by C. Denize, Instructor in Agriculture, Department of Agriculture, Invercargill.

13 July—"Winton Experimental Farm", by W. Faithful, Fields Instructor, Department of Agriculture, Invercargill.

20 July—"Milking Machines", by G. Hicks, Dairy Instructor, Department of Agriculture, Invercargill.

27 July—"Preparing for Spring", by J. P. Anderson, Veterinarian, Department of Agriculture, Invercargill.

Regular Sessions

1XH Hamilton, Mondays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (stock sale review).

1XN Whangarei, Mondays at 8.5 p.m., Wednesdays at 8.1 p.m. (Northland stock market report), Fridays at 8.1 p.m.

1YA Auckland, Mondays at 7 p.m. (Auckland stock market report), Tuesdays at 12.35 p.m., Wednesdays at 7 p.m., Thursdays at 12.33 p.m.

1YD Auckland, Thursdays at 7.30 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock market review), Tuesdays at 7 p.m. (Hamilton stock market report), Wednesdays at 7.15 p.m. (Pig Council talk on fourth Wednesday of every other month), Thursdays at 12.33 p.m. and 7.15 p.m. (fortnightly).

2XA Wanganui, Wednesdays at 8 p.m. (Wanganui stock sale report), Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m., Fridays at 8.2 p.m. (Gisborne stock market report).

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8.1 p.m.

2YA Wellington, Mondays at 7.15 p.m., Thursdays at 12.33 p.m., Fridays at 7 p.m. (Feilding stock market report).

2YZ Napier, Tuesdays at 12.12 p.m. (Hawkes Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m. (Hawkes Bay-Poverty Bay livestock market report), Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m. (Feilding stock market report).

3XC Timaru, Mondays at 8 p.m., Tuesdays (fortnightly) at 8 p.m., Wednesdays at 8.5 p.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m. (Addington stock market report), Thursdays at 12.33 p.m. and 7.15 p.m.

3YZ Greymouth, Thursdays at 12.33 p.m.

4YA Dunedin, Wednesdays at 7.20 p.m., and 9.15 p.m., Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m., Tuesdays at 7 p.m.

Improvement of Hill-country Pastures by Oversowing

IMPROVEMENT of hill-country pastures by oversowing clovers was discussed by the writers of this article, F. E. T. Suckling, Technical Officer, and G. S. Harris, Agrostologist, both of the Grasslands Division, Department of Scientific and Industrial Research, Palmerston North, in the September 1951 issue of the "Journal", and results obtained from a series of 1-acre plots sown in March, April, May, August, September, and October of 1948 were quoted. The trial areas were distributed over the southern half of the North Island and were chosen to give a wide range of soil types and climatic conditions.

Typical hill country which is capable of improvement by surface sowing.

THE previous report gave detailed results of the strike of clovers and grasses for each monthly sowing, and it was recorded that of the sown species red, white, and subterranean clovers established most successfully, and that March was the best month for sowing in all trial areas. Because some doubt has been expressed as to the efficiency and economics of surface sowing, the areas were revisited during November 1953 and measurements were made of the contribution made by clovers to ground cover. During the intervening period the oversown areas had been subjected to a variety of management conditions and most had received follow-up dressings of superphosphate.

So successful has been the establishment and spread of clovers that it was now impossible to count individual plants, as was done previously, and a method of estimating ground cover, using a foot-square frame divided into 3in. squares, had to be used. An endeavour was made to estimate the proportion of the surface covered by the sown species only (white, red, subterranean, and strawberry clovers and *Lotus* species). No estimate was made of what are usually termed annual clovers, though in many places it was obvious that these were making no mean contribution to the ground cover and to seasonal production. The results are given in Table 1 as percentages of ground surface covered by the different species.

Similar counts on control areas where no seed had been sown showed a range of between 5 per cent. and 10 per cent. ground cover of the clovers listed in Table 1. Of these, subterranean clover was the most prominent and had undoubtedly been transferred by stock from the sown areas.

The following points arise from a consideration of the counts.

1. Subterranean clover has persisted in all the oversown plots despite the fact that most of the areas have been under normal sheep farm management involving continuous close grazing. It is concluded that spelling subterranean clover is not necessary to ensure natural reseeding.

2. Red clover (that is, Montgomery red) was present in varying proportion in all trial areas. Under continuous grazing the red clover plants had assumed a prostrate growth habit, and little reseeding can have taken place. Despite this there is every indication that the species will be present for several years to come. Even on the drier faces, where annual clovers were wilting after 3 weeks' dry weather, the red clover plants were most conspicuous by healthy and vigorous growth.

3. In the higher rainfall areas white clover had persisted and spread and was reasonably well distributed throughout the sward except on extremely dry knobs. Under lower rainfall conditions the distribution was patchy and confined more to moister hollows and seepage areas.

4. *Lotus major* was present in almost every trial area. In dry localities it was making a contribution to forage only on the steeper shady slopes and in moist hollows. In the areas subject to higher rainfall it was more evenly distributed in the pasture and was making a greater contribution to the herbage yield.

5. Strawberry clover was observed on two trial areas only. In these it occurred on slip faces where moisture supply was adequate over the greater part of the year because of seepage or other factors.

TABLE 1: EXPERIMENTAL AREAS AND PERCENTAGE GROUND COVER

Location of experimental area	Percentage ground cover				
	Subterranean clover	Red clover	White clover	*Lotus* species	Total
Southern Hawkes Bay					
Horoeka	27	Trace	5	—	32
Ti-Tree Point	16	2	16	—	34
Mangahei	8	2	13	3	26
Coonoor	10	1	22	1	34
Wairarapa					
Matahiwi	2	3	6	—	11
Stronvar	4	1	6	—	11
Gladstone	24	Trace	8	—	32
Hinakura	11	2	4	—	17
Taranaki					
Kohuratahi	12	2	12	1	27
Kohuratahi	11	3	11	1	26
Kohuratahi	3	Trace	5	Trace	8
Tahora	9	1	11	1	22
Taumarunui					
Kaitieke	15	2	13	1	31
Kaitieke	3	Trace	5	Trace	8
Otangiwai	6	2	10	Trace	18
Otangiwai	8	2	12	Trace	22

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In brief, it may be stated that both subterranean and red clovers have thrived on the more droughty soils, whereas white clover and *Lotus* have done best where the moisture supply does not fail during summer.

It is interesting to compare the initial strike with the percentage ground cover after 5 years. The results for plots sown in March are shown in Table 2.

The features to be noted are:—

1. Red clover, although it established well, has become a minor constituent of the pasture after 5 years.
2. Subterranean clover established readily and has persisted under a wide range of conditions.
3. Only a small percentage of the white clover seeds "struck", but because the seeds are small and numerous the seedling population was adequate. With white and subterranean clovers a seedling population of 2 to 5 to the square foot was sufficient to enable either species to take up a place in the pasture, where it occupied between 5 and 27 per cent. of the area.
4. *Lotus* did not become an important constituent of the pasture even where the seedling population was high.

Conclusions

The trials demonstrated that oversowing is a practicable means of replenishing clovers in hill pasture and this has been confirmed by other experiments carried out under a still wider range of soils and climate and by the practical experiences of many farmers.

What clover species should be sown depends on the soil and climate. Subterranean clover and red clover are most suitable for light soils and dry climates, whereas white clover and *Lotus* thrive best on heavier, wetter soils. But soil and growing conditions vary greatly in hill country so that it is generally advisable to sow a mixture of clover species.

TABLE 2: COMPARISON OF GROUND COVER AFTER 5 YEARS

Locality	Species of clover	Establishment 1948 Seedlings as a percentage of viable seed sown	Average number of plants per square foot	Percentage ground cover for each species 1953
Mangahei	Red	42	9	2
	White	32	4.8	13
	Subterranean ..	58	1.5	8
	Strawberry ..	.8	.05	—
	Lotus	4	.8	3
Coonoor	Red	46	10	1
	White	29	4.3	22
	Subterranean ..	94	2.5	10
	Strawberry ..	—	—	—
	Lotus	6	1.2	1
Ti-Tree Point	Red	24	5	2
	White	22	3.2	16
	Subterranean ..	98	2.6	16
	Strawberry ..	1	.06	Trace
	Lotus	—	—	1
Horoeka	Red	24	5	Trace
	White	5	.8	5
	Subterranean ..	65	1.8	27
	Strawberry ..	—	—	—
	Lotus	1	.2	—
Mangaweka	Red	14	3	Trace
	White	45	6.8	22
	Subterranean ..	98	2.6	5
	Strawberry ..	1	.06	—
	Lotus	65	13	1

Left—Clover deficient pasture common on much New Zealand hill country. Right—The result of clover oversowing and the right management.

Where clovers are absent from long-established pastures it is probable that there are deficiencies in soil fertility. Unless these deficiencies are made good by topdressing, clovers introduced by oversowing will lack vigour and may fail to survive. In many places superphosphate alone is adequate, but elsewhere other fertilisers such as lime, potash, or molybdenum are needed. Where pasture improvement by oversowing is attempted it is essential that the fertiliser requirements of the particular soil should be known.

Management plays an important part in ensuring success in oversowing. Where lax grazing is practised clover seedlings are smothered by rank grass. All the writers' observations indicate that close grazing before sowing creates the most favourable conditions for the establishment of oversown clovers. After the clover plants are well established some advantage may accrue from lax grazing or complete spelling during summer. This treatment permits white clover, *Lotus*, and even red clover to increase by natural reseeding.

It is the writers' opinion that the most sound and economical approach to hill pasture improvement is made where each year an oversowing programme is carried out completely and thoroughly on only a part of the farm. Each paddock can then be sown evenly with a heavy seed mixture, properly topdressed, and stocked to keep the pasture short. Stock numbers can be built up gradually to cope with the additional feed by saving more replacements and even by retaining some of the sounder 6-year-old ewes.

Improvement is greatly facilitated where there is adequate subdivision. A uniform clean-up of pastures can then be achieved by mob stocking, and, more important still, pastures can be saved for periods of shortage. At the Te Awa research area it has been found possible to double the carrying capacity by subdivision alone without topdressing or oversowing.

Where wide-scale oversowing and topdressing are practised large numbers of additional stock must be brought in. Otherwise there is a great wastage of feed and little benefit is gained from the pasture improvement.

Reference

"The New Zealand Journal of Agriculture", September 1951, p. 191.

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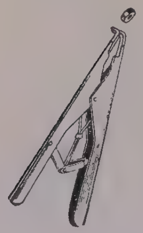

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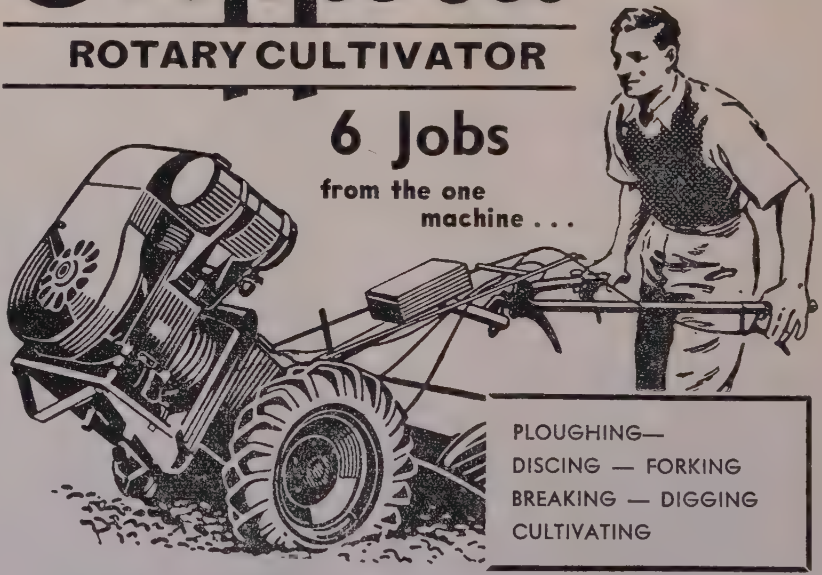

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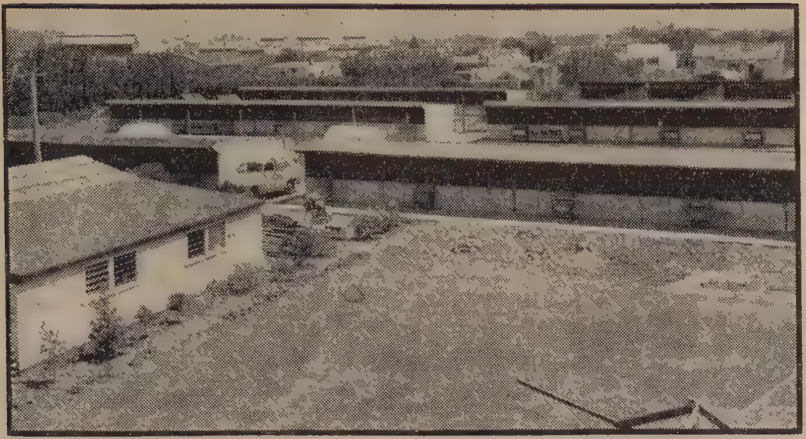

Poultry Flock Improvement Plan: Data on Average Egg Production and Poultry Losses

RELIABLE figures of average egg production in the poultry industry in New Zealand have always been difficult to obtain. Such figures may be obtained from a survey of production, samples of egg production being taken of laying flocks of different sizes from all the main producing areas of the Dominion. The last survey of this kind was made by W. N. Paton, Senior Investigational Officer, Department of Agriculture, Wellington, for the season 1940-41. In 1953 the conditions of the New Zealand Poultry Flock Improvement Plan were expanded to include a section under which accredited poultry breeders are required to record the egg production of a proportion of their pullets. Though it is not claimed that the figures of production obtained from breeders who have recorded pullets under this section constitute a survey of egg production on an industry basis, the data collected are of interest and if collected over a period of years, will constitute a basis for assessing the trend of egg production in New Zealand. In this article F. C. Bobby, Superintendent, Poultry Industry, Department of Agriculture, Wellington, discusses the egg recording section of the New Zealand Poultry Flock Improvement Plan and reviews the data obtained during the season 1953-54.

THE New Zealand Poultry Flock Improvement Plan was started in 1945, during which year 28 breeding flocks consisting of 5508 breeding females were accredited. For 1953 the figures 139 flocks and 65,404 breeding females clearly indicate that the plan is well established. However, the plan was criticised on the score that its conditions did not take into consideration the egg production of the flocks accredited. This criticism was justifiable to a point for a plan that claimed to have as a main objective commercial stock improvement. Unfortunately the critics failed to offer any suggestions as to how egg production efficiency in accredited flocks could be assessed.

Those responsible for the control of the plan were alive to the need for measuring average egg production, but realised also the difficulties of formulating a scheme which would be suitable to general poultry practice in New Zealand.

In the United States of America and the United Kingdom it is common practice among poultry breeders to trapnest their pullets and to keep comprehensive records. These records are a reliable source of information of egg production and are open to inspection to those responsible for administering accreditation or stock improvement plans in those countries. In New Zealand, on the other hand, few poultry breeders can afford to trapnest pullets. Consequently it was necessary to adopt a simple scheme which could be carried out by any poultry breeder without undue additional labour being needed. One of the difficulties with obtaining a reliable figure for pullet egg production is the fact that laying houses are filled at different times at the beginning of a season and likewise have to be emptied at varying stages at the end of the season when blood testing for pullorum disease and the selection of future breeders have to be carried out. It is difficult, therefore, to obtain a static flock numerically on which to assess average egg production.

Mortality and culling during the laying period are important considerations. Often attractive-looking averages can be obtained if they are assessed on survivors of a laying flock at the end of a season. It is contended, however, that such averages are misleading and are not truly representative of the number of eggs that a producer has obtained from a flock of layers which was raised for the production season. To obtain a better picture which is more closely related to the true economic position a poultry breeder should assess average egg production per bird on a "flock-housed average", namely the total eggs produced by a flock of pullets during a given period, divided by the number of pullets housed at the

HEADING PHOTOGRAPH: Laying houses on a well-laid-out poultry farm of an accredited breeder who carries out egg recording with a group of pullets. Greenfeed is taken from the lawn in foreground.

TABLE 1: AVERAGE EGG PRODUCTION PER MONTH ON A FLOCK-HOUSED AVERAGE FOR WHITE LEGHORNS AND AUSTRALORPS IN THE NORTH AND SOUTH ISLANDS

	January	February	March	April	May	June	July	August	Sept.	October	November	December
						White Leghorns						
No. of pullets	230	810	2,206	3,019	3,019	3,019	3,019	3,019	3,019	3,019	2,789	2,009
Eggs per pullet	12.72	11.37	12.97	12.48	14.03	13.12	14.00	16.05	16.57	16.24	15.16	14.62
						Australorps						
No. of pullets		460	930	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,340	1,080
Eggs per pullet		9.7	16.16	15.66	16.53	16.27	15.75	16.69	17.55	17.27	15.50	12.17

TABLE 2: WHITE LEGHORN EGG PRODUCTION, MONTH BY MONTH, IN NORTH AND SOUTH ISLANDS

						North Island						
No. of pullets	100	500	1,369	1,859	1,859	1,859	1,859	1,859	1,859	1,859	1,759	1,359
Eggs per pullet	11.09	9.84	12.82	12.29	13.54	13.02	13.76	15.69	15.89	15.93	15.4	15.29
						South Island						
No. of pullets	130	310	810	1,160	1,160	1,160	1,160	1,160	1,160	1,160	1,030	650
Eggs per pullet	18.13	13.83	13.22	12.79	14.81	13.28	14.40	16.63	17.66	16.75	14.67	13.21

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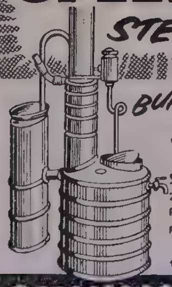

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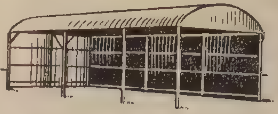

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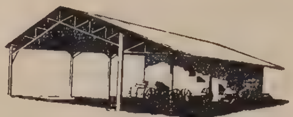

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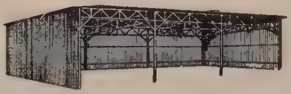

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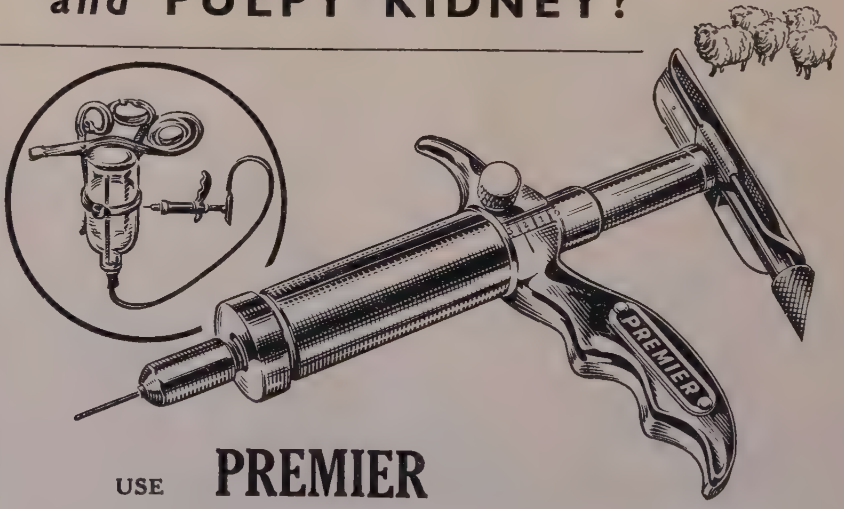

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beginning of that period. This method includes the factor of wastage during the laying season from deaths and culling, and in consequence shows a more relative figure for average egg production.

The Dominion Committee controlling the conditions under which the Poultry Flock Improvement Plan is administered decided on the following simple scheme of assessing average pullet egg production on accredited breeder farms.

1. A sample flock of pullets representing **not less than** 12½ per cent. of the total laying birds of the breed recorded is legbanded at the start of the laying season.

2. Daily egg production of these pullets is recorded on sheets specially designed for the purpose, these sheets being sent at regular intervals when completed to the Department of Agriculture for checking and compilation.

3. Egg production is recorded over a stated period each year, during which no birds may be added to the flock. Obviously deaths may occur and culls may be removed, but otherwise the flock must not be moved or broken up for the period named.

This simple scheme involves little extra work other than the legbanding of the birds at the start. A true flock-housed average is ensured because the number of birds is fixed at the start (no guesswork as to the approximate number of birds put in the house or pen) and the flock must remain static in number except for mortality and culling throughout the period of recording.

For the season 1953-54 poultry breeders were permitted to start recording on the first day of January, February, March, or April according to their wishes. This was permitted as it was considered that climatic conditions and hence the seasons of the year vary to some extent with consequent effect on poultry management and production in areas as widely separated as Whangarei in the north and Invercargill in the south. Subsequent experience has indicated that the majority of breeders select 1 March irrespective of the breed maintained or the district. Consequently in future years egg recording under the scheme will be started on 1 March.

The period of recording chosen was 10 calendar months, but during 1953-54 a number of breeders in the scheme were forced to break up their pullet flocks before the end of 10 months and thus could not complete the recording period. Consequently the period is reduced to 8 calendar months for 1954-55. For comparison of the figures it will be essential to stabilise this period at 8 months. The period of recording providing it is reasonable, is not the all-important factor. The essential is that figures should be obtained over a similar period each year and thus may be compared as a guide as to whether progress is being made. Such figures over a period of years are of considerable value to the individual breeder, and converted into Dominion averages for all flocks recorded, the figures supply information as to the trend of average production for the more popular breeds in the Dominion.

Results in 1953-54

Though over 40 poultry breeders applied to record pullet flocks during the laying season in 1953-54, a number were forced to withdraw from this section of the plan or were unable to complete the 10-months' period of recording. Thirty-one flocks of pullets completed the recording period and the figures given are based on 31. A summary by breed and islands of these flocks is as follows:—

	Flocks	Pullets
North Island		
White Leghorns ..	14	1,859
Australorps ..	7	1,200
South Island		
White Leghorns ..	8	1,160
Australorps ..	2	140
	31	4,359

Table 1 sets out the average egg production per month on a flock-housed average for White Leghorns and Australorps in the North and South Islands. As stated the breeders recording pullets were permitted to start on the first day of one of four months. Consequently for the year reviewed average egg production figures per pullet are available from January to December, and for obvious reasons the number of pullets producing eggs on which these averages are based varies at the beginning and the end of the year.

Table 1 shows that peak production for White Leghorns and Australorps was reached in September, but in general production is steady at a high rate over August, September, and October. Australorps had a marked advantage in production during winter as compared with White Leghorns. Broodiness among Australorps in spring and summer did not appear to affect egg production seriously as compared with White Leghorns, a non-broody breed.

Table 2 compares egg production of White Leghorns, month by month, in North and South Island flocks. Though there is not a marked difference between the flocks in the two islands, the advantage lies with those in the South Island.

Even in winter when climatic conditions in the South Island are more severe than in the North Island this fact is not reflected in the South Island production.

The flock-housed averages for the 10 months over which each of the flocks was egg recorded were:—

Dominion: White Leghorns, 143.8 eggs per pullet; Australorps, 159.9 eggs per pullet.

North Island: White Leghorns, 142.3 eggs per pullet.

South Island: White Leghorns, 145.4 eggs per pullet.

As there were only two small flocks of Australorps from the South Island (140 pullets), no comparison between the two islands for this breed is practicable. In 1952 before the egg recording section of the Poultry Flock Improvement Plan was started officially figures were kept by seven breeders of White Leghorns (1050 pullets) for 10 months, flocks being in both islands. The flock-housed average for these seven breeders was 144 eggs, a figure very closely related to the result obtained with White Leghorns in 1953. There were insufficient breeders keeping figures for Australorps in 1953 to give a comparable figure for this breed. Recording on an unofficial basis was carried out in 1952 to allow the Department of Agriculture to find any administration difficulties before the egg recording section of the plan was put into operation.

Of the 31 poultry breeders who recorded pullets in 1953, the year under review, 17 obtained a flock-housed average equal to or greater than the Dominion average for the two breeds recorded. The results were:—

White Leghorns: 22 flocks, 11 accredited.

Australorps: 9 flocks, 6 accredited.

No individual flock-housed averages for breeders may be given, as they are confidential to the producers they concern, but the results covered a wide range. The best results were more than 170 eggs per bird and the lowest were less than 100 eggs per bird. It is obvious that the incomes on farms giving such widely differing production must vary substantially.

A list of the names of breeders who were accredited for egg production may be obtained from Poultry Instructors or on application to the Superintendent, Poultry Industry, Department of Agriculture, P.O. Box 2298, Wellington.

Mortality and Culling

The egg recording section of the Poultry Flock Improvement Plan also supplies data of the wastage which occurs in pullet flocks. It is debatable whether figures for mortality and culling can be lumped together, though the two together do constitute wastage in the flock, that is those birds which cease egg production. A high proportion of birds culled would in fact ultimately come under the heading "mortality" if they were not removed from the flock before they died.

Total wastage figures were:—

White Leghorns, 17.6 per cent.

Australorps, 15.1 per cent.

At least two breeders removed a number of broody Australorp pullets from their flocks, which increases the wastage for this breed. From the returns received it was noted that 7.7 per cent. White Leghorns and 5 per cent. of Australorps were recorded as "died".

The comparable figures from the Breeders' Laying Trial, Poultry Demonstration Plant, Upper Hutt, for the past 5 years were:—

	1949-50 Per cent.	1950-51 Per cent.	1951-52 Per cent.	1952-53 Per cent.	1953-54 Per cent.
Heavy breeds (mainly Australorps) ..	12.5	10.8	19.4	12.9	15.4
Light breeds (White Leghorns) ..	18.1	16.2	13.4	17.1	22.8

A close relationship is shown between the Poultry Flock Improvement Plan figures and those of the Breeders' Laying Trial over the 5 years for both breeds.

Egg Recording in 1954

In 1954, 40 accredited poultry breeders have legbanded pullets and are recording egg production. It is expected that a report similar to that given will be published in January 1955.

Control of Fusarium Wilt in Cucumbers under Glass

By M. RICHARDS, Lecturer in Horticulture, Massey Agricultural College, Palmerston North

GROWERS of cucumbers under glass have suffered heavy losses in recent years through attacks of fusarium wilt (*Fusarium oxysporum* Schl.). Soon after the onset of cropping the plants wilt and die, the first symptoms closely resembling water deficiency. So far control of the disease has been extremely difficult. The fungus lives in the soil, attacking the plant through the roots, and when the symptoms appear above ground the plant cannot be saved.

STEAM sterilisation of the soil will kill the fungus, but the soil is easily reinfected, and the expense of sterilisation is then an additional loss. Attempts to prevent the spread of the disease by watering the soil with fungicides, notably Cheshunt compound, Cuprox, and Phygon, have had only very limited success. There are at present no resistant varieties of glasshouse cucumbers in cultivation.

This disease is not confined to New Zealand, but occurs in most countries where glasshouse culture of cucumbers is practised. In Holland severe attacks of fusarium wilt in the Westland area made cucumber culture an uneconomic proposition for several years. During a tour of the Dutch horticultural industry in 1952 the author saw Dutch growers grafting cucumber plants on to a resistant rootstock. Inquiries elicited the fact that the species used as rootstock was *Cucurbita ficifolia*, native of eastern Asia, and a close relative to the pumpkin. Plants growing on this rootstock were vigorous and appeared to crop well.

In the season of 1952 Mr. S. M. Nairn, a Palmerston North grower, suffered severe losses from fusarium wilt. This seemed an ideal opportunity to try the efficiency of the grafting method under New Zealand conditions. By the co-operation of the University of Wageningen, Holland, a small supply of seed of *C. ficifolia* was sent to Massey Agricultural College for this purpose.

Seed of the stock and the scion variety was sown on 10 July, this being the normal sowing date for this grower. The seeds were sown individually in 3in. pots, and placed in a propagating frame at 70 degrees F. in the college glasshouses. Because of conflicting reports of incompatibility between stock and scion, grafting was delayed until the first true leaves of the stock had expanded. Grafting above the cotyledons overcomes this incompatibility.

A simple cleft graft was used, with slight variations to determine a suitable technique. The grafting is a delicate but not difficult operation. Wool was used for tying, but this is difficult to handle, and raffia is probably equally satisfactory. The grafted plants were returned to the propagating pit and maintained under humid conditions. Union between stock and scion occurred in 10 to 14 days, but the ties were left in position for 21 days to prevent breakage at the union.

To secure sufficient growth on the stock most plants were repotted into 4in. pots. It has now been ascertained that no incompatibility exists between stock and scion; therefore grafting can be carried out below the cotyledons and repotting will be unnecessary.

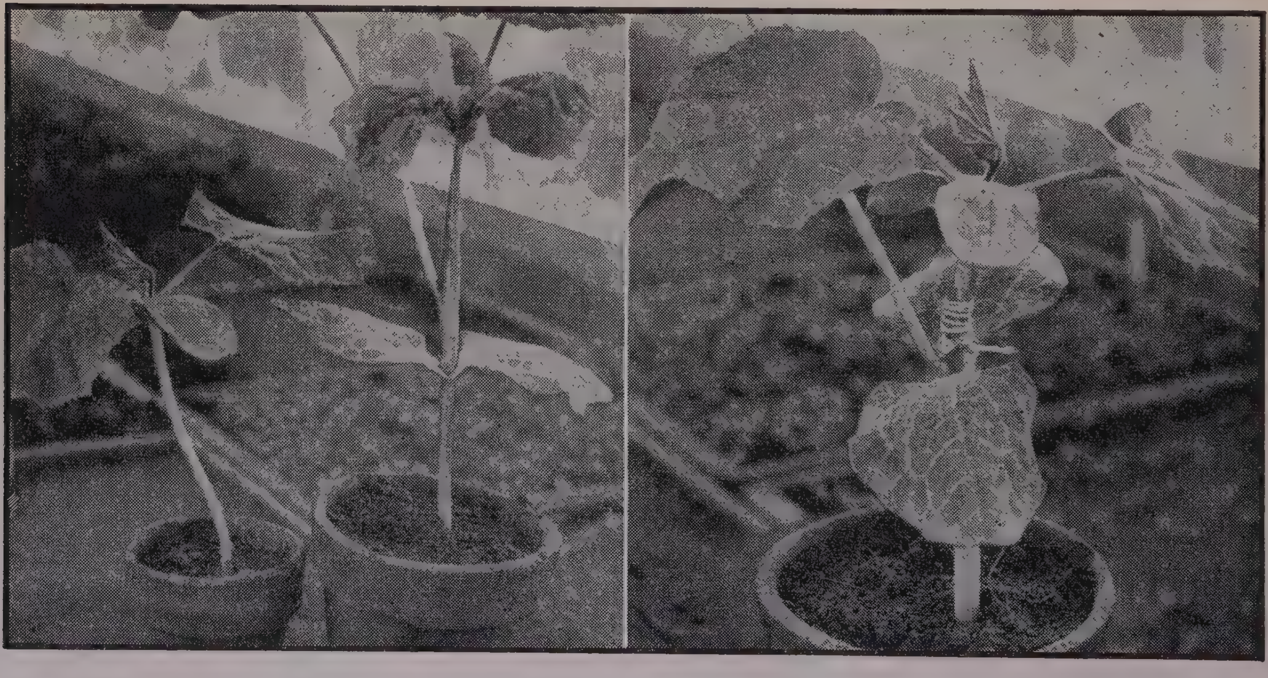
The grafted plants were planted out on 14 October in a commercial glasshouse. They were slightly smaller than ungrafted plants sown at the same time, and it would appear necessary to start grafted plants about 7 to 10 days earlier.

Despite the fact that all soil in the glasshouse had been sterilised, a severe attack of fusarium developed in mid-September. By 1 November all ungrafted material in the house was dead, but the grafted plants showed no ill effects whatsoever. The disease spread from one corner of the house and affected ungrafted plants on both sides of the grafted material.

The cropping of the grafted plants was not as good as could have been expected from normal plants. No accurate cropping records were kept, as the object of the trial was to determine the immunity of the stock under New Zealand conditions. It would appear, however, that under a different system of training the grafted plants would give crops equal to that which can be expected from normal plants.

It is planned to repeat the trial in 1954, and attempts are now being made to build up supplies of seed of *C. ficifolia*. This will allow further investigation into the best techniques for grafting and into the best system of training of grafted plants. Both investigations will be necessary before the method could be recommended for normal commercial practice.

Acknowledgment is made to Professor S. J. Wellenseik of the University of Wageningen for making seed available.



Left—Cucumber plant (left) and the prospective rootstock grown from seed of *Cucurbita ficifolia*, a fusarium-resistant close relative to the pumpkin. Right—Simple cleft graft of the two plants at left.

Pig Housing

HEADING PHOTOGRAPH: Pigs fatten quickly in a comfortable house. The objective in building fattening houses is to secure maximum efficiency in food conversion. B. Snowden photo.

Fattening House Design

DETAILS of designs which have proved satisfactory as fattening houses are dealt with in this article by A. Longwill, Superintendent, Pig Industry, Department of Agriculture, Wellington. It is the fifth of a series dealing with the housing of pigs in New Zealand. A variety of designs is described so that a selection according to particular requirements can be made.

MOST fattening is done, under New Zealand seasonal production conditions, in summer, when temperatures vary, with few exceptions, between 55 and 80 degrees F. in the North Island. Excessive heat is therefore more likely to be a problem than cold with fattening pigs. No doubt this has influenced the design of houses which have open fronts and large air space and the minimum of provision for insulation for roof or walls. Three facts, however, appear to have been overlooked in placing most emphasis on "fresh air and sunshine". These are:—

1. The daily range of temperatures is frequently about 20 degrees F., and such a range can detrimentally affect efficiency of food conversion.
2. The fattening house must accommodate pigs from the weaner stage onward, and young pigs must be able to keep themselves warm when put in at the beginning of the season. Poor results in early growth at that time can seriously affect the whole season's output.
3. In the dairying districts bedding is usually scarce, and in the absence of it a warm sleeping floor or some form of control over ventilation is even more important.

Main Requirements

The principal requirements of the fattening house may be summarised as follows:—

A bed area of 5 sq. ft. to 6 sq. ft. per baconer and a feeding area approximately the same are required. If the two areas are not subdivided, a total of 10 sq. ft. per pig is adequate. Where a dunging area is provided a further 4 sq. ft. per pig will be needed plus approximately 1 sq. ft. per pig represented by the passage between feeding and dunging areas.

The roof should be kept as low as convenient for access and cleaning out and should be insulated to reduce heat loss in cold weather and overheating in summer.

The sleeping bed area should be capable of being closed to reduce ventilation to manageable proportions. If the roof extends over the whole house, suitable means of control of ventilation, by totally enclosing the building or by providing a cover and shutters for the sleeping area, is required.

The floor of the sleeping area should be of insulated construction so that it retains the heat transmitted to it by the pigs lying on the bed. The whole floor should be laid on hard fill and should be impervious to moisture. Drainage falls of ½in. to each 1ft. should be provided away from trough and bed. Ventilation, under convenient control, must be provided and running water laid on so that on very hot days, when ventilation alone is inadequate to provide comfortable conditions, cooling of the air can be achieved by a spray or trickle of water on the feeding or dunging area floors.

Trough room of 1ft. per pig for baconers and 9in. per pig for porkers must be provided. Glazed half pipes of 12in. diameter are best for troughs.

Materials used in construction should be chosen to give as good heat insulation as is practicable consistent with reasonable cost. In addition to the

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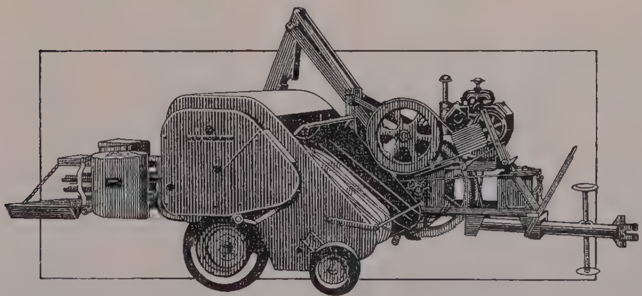

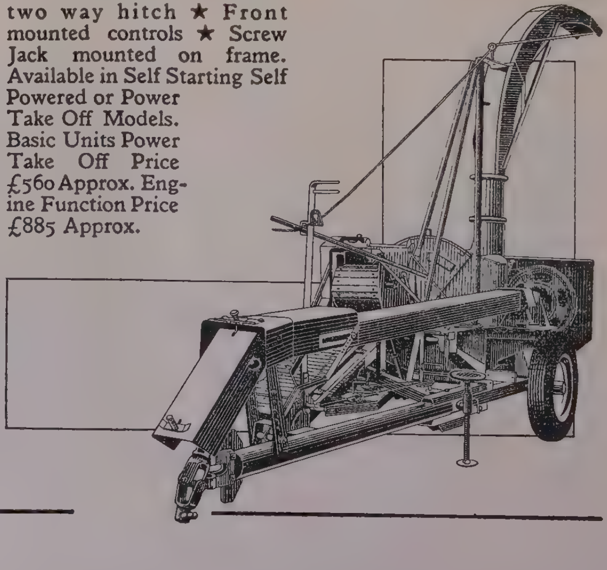

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points already mentioned it would be an advantage to have the outside walls built in cavity construction, plastered on the outside with ¾in. gypsum plaster, and finished with a light coloured waterproofing paint.

Simple Plan

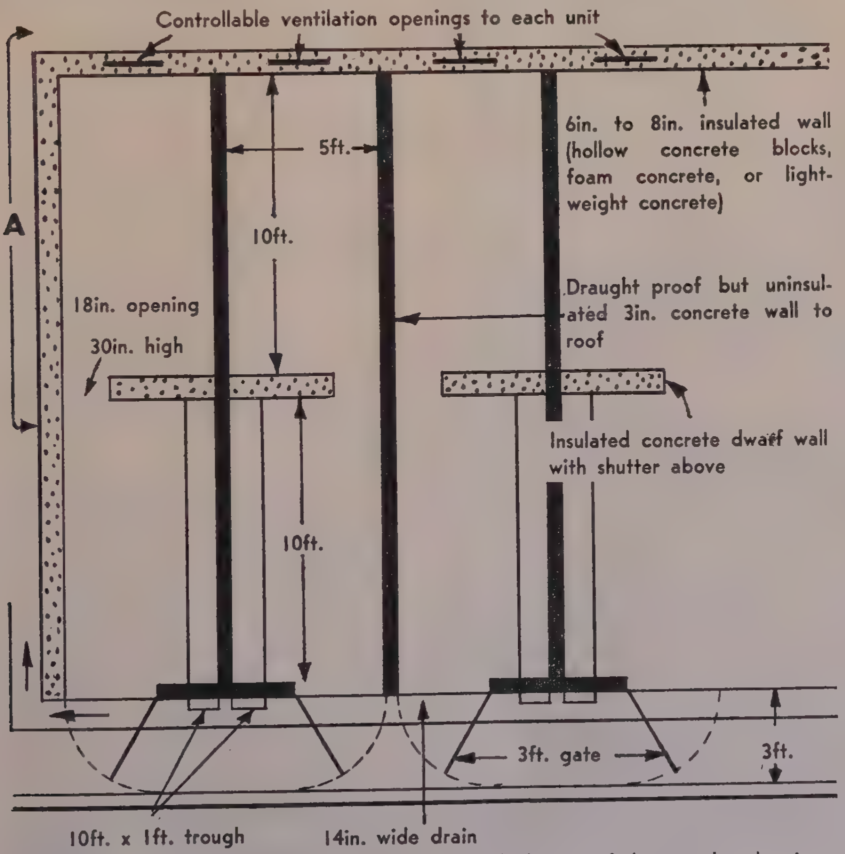
The most economical design of house which will conform to the requirements outlined is probably the simple, forward-draining type roofed over the sleeping quarters only and with the front protected by hinged shutters.

The plan of such a house which, through using troughs along the division walls between pens, minimises floor area is shown below. The dimensions and shape of sleeping quarters minimise the materials used and surface areas exposed to the outside in relation to the number of pigs which can be housed. Provided the roof over the sleeping area is insulated and is not higher than 5ft., the 10 pigs up to baconer weight which can be accommodated in each pen can keep the air space of their unit warm under all conditions normally encountered in New Zealand.

A 2ft. 6in. dwarf wall of hollow blocks or other material with good insulating properties and shutters enable the front to be closed up with the exception of an 18in. x 30in. entrance. Ventilation can be controlled to some extent by adjusting the opening of an 18in. x 9in. inlet vent in the back wall of each pen (see the diagram on page 501 of the May issue of the "Journal").

Where forward drainage and the situation of the trough suit the particular circumstances the design illustrated below will be satisfactory. If desired, the roof may be extended to cover the feeding area and feeding race along the front of the pens. However, unless adequate extra material, including insulation for the whole roof and preferably also for outside walls, is used—which will add considerably to the cost—the warmth-conserving qualities of the smaller house will be lost.

Another design which has claims to be considered as a fattening house and which ranks high for simplicity and low cost yet meets the requirements for efficient conversion of food, is referred to on page 329 of the April issue of the "Journal". Plans are available from Publications Section, Department of Agriculture, Wellington, at 5s. per copy. This house has a sleeping area of 66 sq. ft., or 6½ sq. ft. per pig, and air space of approximately 330 cub. ft., which is adequate —probably even somewhat excessive for optimum conditions—for 10 pigs to baconer weight. With the larger houses which are dealt with later in this article the extra air space which has to be kept warm must be compensated for by better insulation and control of ventilation. There is the advantage of protection for the worker where the feeding race is enclosed in the house, but such a design is obviously more costly if built to secure the same performance from the pig which the smaller house will give.


Controllable ventilation openings to each unit
5ft.
6in. to 8in. insulated wall (hollow concrete blocks, foam concrete, or light-weight concrete)
A
10ft.
18in. opening
30in. high
Draught proof but uninsulated 3in. concrete wall to roof
Insulated concrete dwarf wall with shutter above
10ft.
3ft. gate
3ft.
10ft. x 1ft. trough
14in. wide drain

Simple plan of forward-draining type of house which is roofed over the sleeping quarters (A) only. It provides 5 sq. ft. of roofed-over area per pig and 20 cub. ft. of air space per pig in the sleeping quarters.

Harper Adams Design

A totally enclosed house of relatively compact design has recently been adapted from a design much publicised in the English farming Press during the last year or two. The prototype of this house was built at the Harper Adams Agricultural College, Shropshire, England, and in turn, was an adaptation of principles of design "insulate and isolate" enunciated by a successful Northern Ireland pig producer, W. McGuckian.

The adaptation of the design which is proving very satisfactory under New Zealand conditions has a 10ft. x 10ft. combined sleeping and feeding floor sloping from the back to the trough, which runs along the front of the pen. The back half of the floor is reduced to 8ft. 6in. to provide a narrow passage out to a dunging yard or race at the back and outside the roofed area. The roof is brought forward over the feeding passage and a front built in, including windows to provide lighting for the house.

The entrance from the outside dunging yard is baffled by a short wall and roofed over. A rubber mat or sack may also be hung in the entrance to reduce draught, though allowing access in and out for the pigs. A wall between the sleeping quarters and the passage to the dunging area prevents draught into the sleeping quarters. It is probably worth while in exposed, windy situations to take this wall to the roof. All walls between pens are taken to the roof, which is kept to the minimum consistent with convenient access. The roof is well insulated and a clearance to the lining (usually under the rafters) of from 6ft. 6in. at the front wall to 4ft. 6in. at the top plate on the back wall is generally found satisfactory. Filling in at the back of the sleeping quarters to give the fall toward the trough will reduce the interior measurement of the back wall to 4ft. or less.

The house is not as straightforward and convenient of access for cleaning as some other designs. However, if pigs are fed carefully the sleeping area should not need to be cleaned often, and any difficulties in cleaning are balanced by the good control which can be attained over temperature. This control is further assisted if the house is completely subdivided at alternate pen subdivisions, or otherwise as required, by placing a door in the feeding passage and completing the wall right through. In winter, particularly if all the house is not in use, the added control of temperature thus made possible may make all the difference between comfort and chilling.

The illustrations on page 553 show the interior of one of the earlier houses of the Harper Adams type built in New Zealand. The fall on the floor is a compound fall from the trough to the entrance. No side wall between sleeping quarters and entrance and no subdivision of the feeding passage were included. The roof is baffled over the entrance and an outside water trough is provided here; this permits use of water to assist cooling in hot weather.

Later amendments to the design have provided for the part of the yard behind the baffle to be used as a race. This is done simply by extending the

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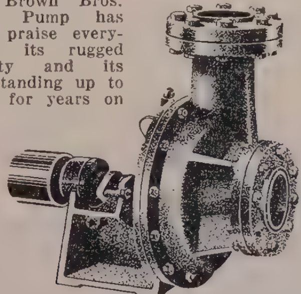

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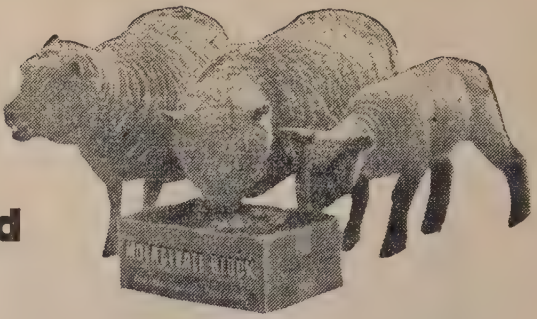

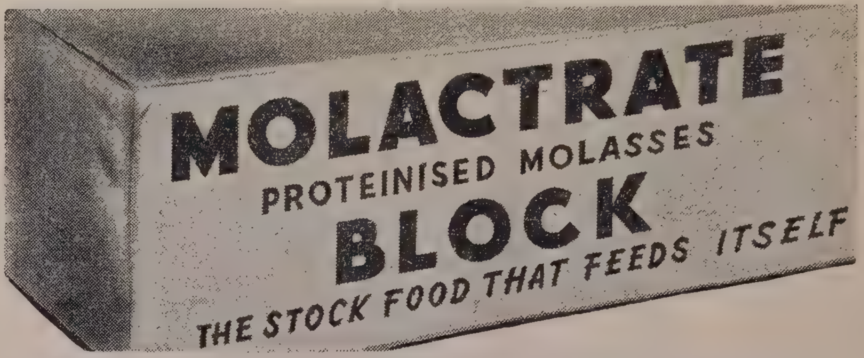

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wings of the baffles to 6ft. and replacing the concrete dividing walls in this part of the yard by gates hinged to the corners of the baffles and swinging from the dividing wall positions. Each gate fastens against the wing of the next baffle when use of the race is required.

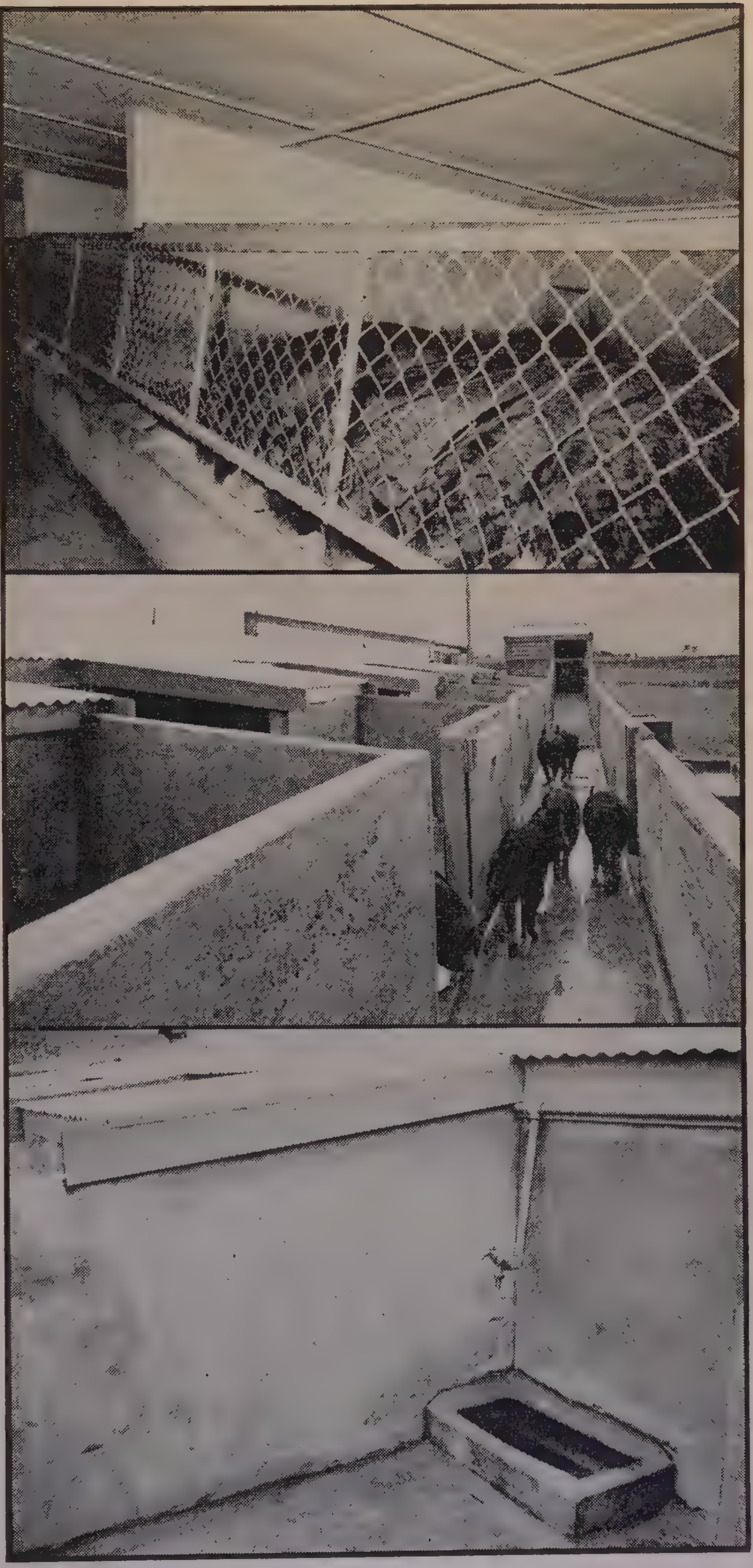
The importance of especially good insulation and reduction of undesirable draughts in such a house is emphasised by the dimensions. The enclosed area is approximately 13 sq. ft. per pig and the air space is about 680 cub. ft., or 68 cub. ft. per pig, compared with less than half these dimensions in the designs discussed earlier.

Double-range houses based on this design have recently been erected at the New Zealand Pig Producers' Council Breeding Centre at Ruakura and at Massey Agricultural College. A centre feeding passage with two opposed sets of pens enables the air space per pig to be reduced somewhat, but the series of entrances in both walls are only baffled and cannot be made draught proof. What the effect of this will be is not known yet and the design must be regarded in the meantime as experimental.

Danish Ground Plan Houses

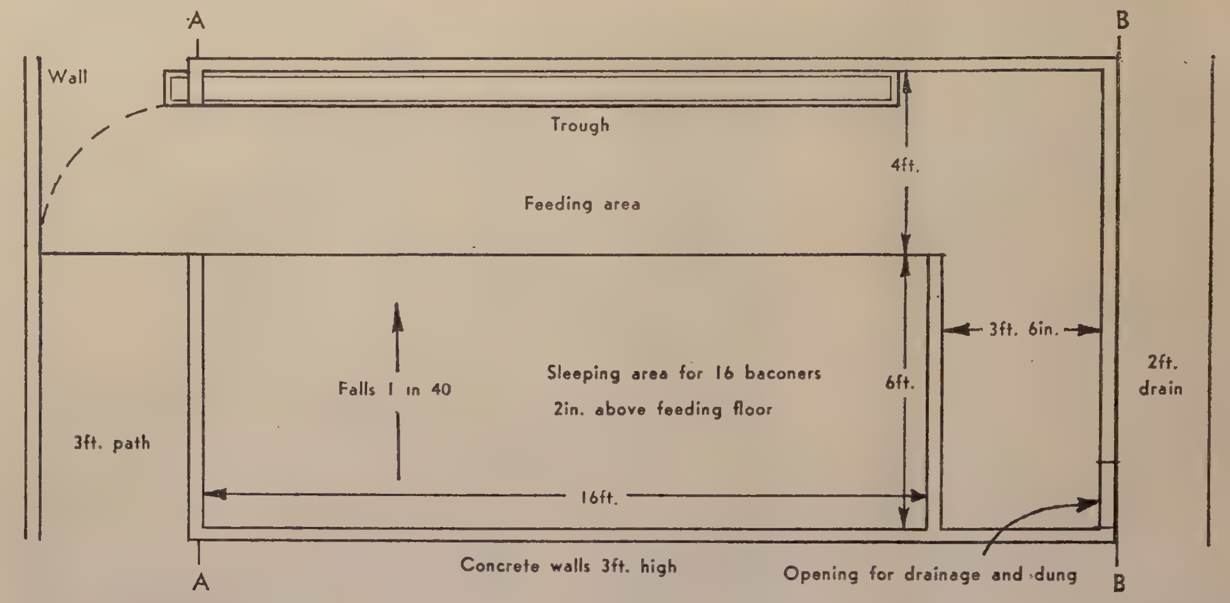
The double-range houses mentioned in the last paragraph are so expensive that they would be beyond the resources of the average producer. Houses of the full Danish design with adequate insulation would be even more costly and therefore out of the question. However, adaptations of the design in which a single row of pens is provided have been used successfully for many years. Probably the most suitable from a consideration of the pigs' comfort is the type illustrated on page 555. This house, which reduces the enclosed area to a minimum consistent with easy working and cleaning of the dunging race, has its roof fall reversed. There is 6ft. 6in. stud height at the back wall, which allows sufficient height for access to clean out, and the height at the front of the sleeping quarters is 5ft. 6in., a reasonable compromise between ease of access and reduction of air space.

The general ground plan provides a 10ft. wide pen with trough across the full width at the front, a feeding area 5ft. deep, and a sleeping bed 8ft. 6in. x 7ft. backed by a 4ft. wide dunging race across the full width of the back of the pen. The wall in front of the sleeping area can be completely closed

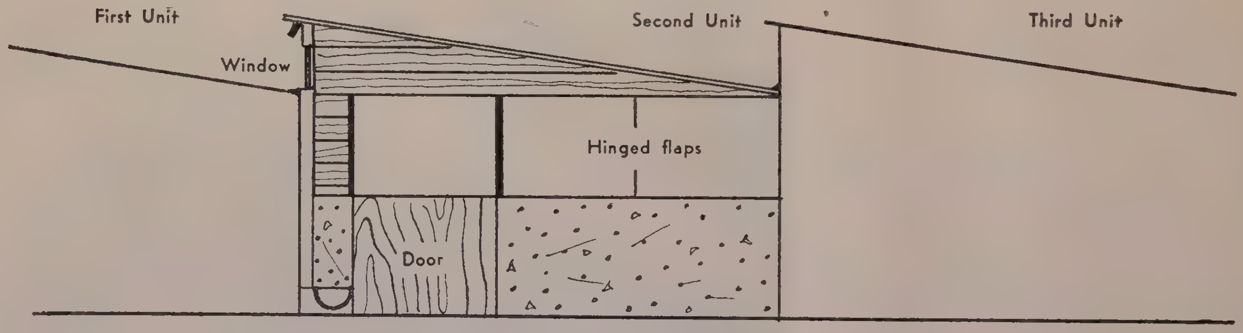


Upper right—Interior of Harper Adams type house, showing well-insulated roof, division walls to roof, and trough and sleeping floor raised above feeding passage level to reduce air space in the house. Middle right—Looking along the rear of the Harper Adams type house. The illustration shows the roofed-over baffle around each entrance. In later designs the division walls between baffles and the interior wall of the race have been replaced by gates. This then provides a race and the outside race shown is omitted. Lower right—A water trough can be provided in the outside yard of each unit of the Harper Adams type house. A spray from the tap over each concrete yard in hot weather will maintain comfortable conditions within the house.

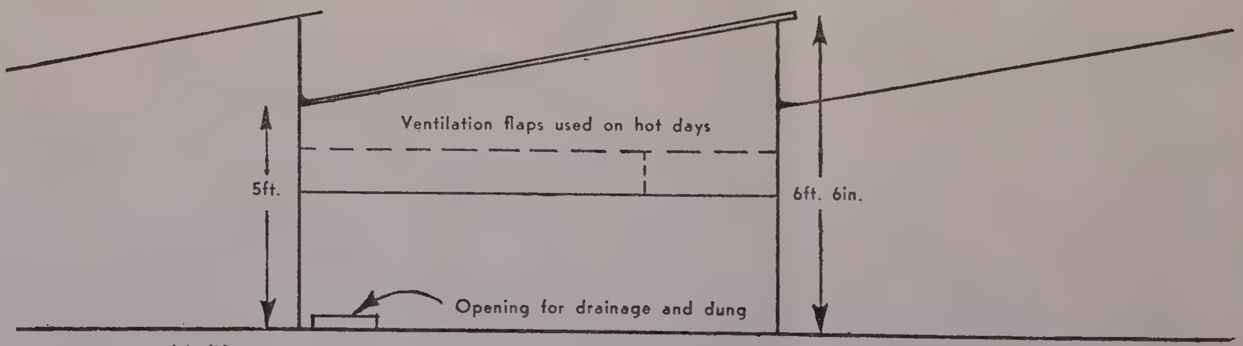
FATTENING HOUSE DESIGN


A
B
Wall
Trough
4ft.
Feeding area
3ft. 6in.
Falls 1 in 40
Sleeping area for 16 baconers
2in. above feeding floor
6ft.
2ft.
drain
3ft. path
16ft.
Concrete walls 3ft. high
Opening for drainage and dung
A
B

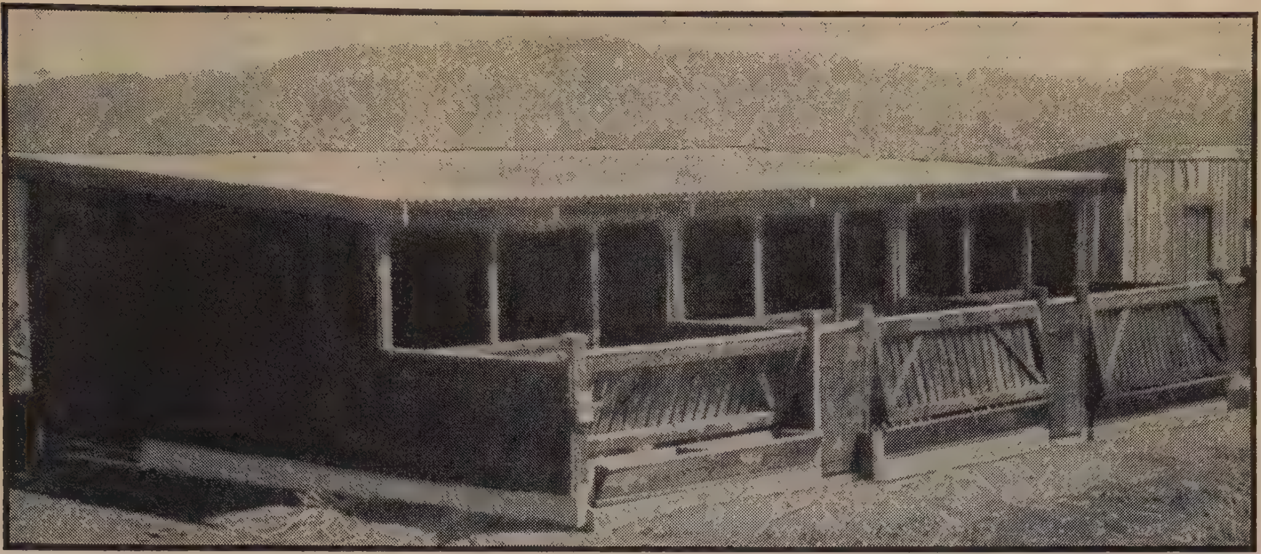
Elevation at AA


First Unit
Second Unit
Third Unit
Window
Hinged flaps
Door

Elevation at BB


Ventilation flaps used on hot days
5ft.
6ft. 6in.
Opening for drainage and dung

Modification of dunging race design used by Mr. J. G. Fowell, of Howick, Auckland.



A fattening house built on the Danish ground plan but with sleeping quarters and dunging race only roofed over. With adjustable shutters in front some control over temperature in the house can be obtained.

by shutters. With the roof covering the dunging race and sleeping quarters only the roofed-over and enclosed area is approximately 110 sq. ft. and the air space 660 cub. ft., which compares favourably with the Harper Adams design. If the walls round the sleeping quarters only are taken up to the roof (which, as described for previous designs, must be insulated), the enclosed area is reduced to 60 sq. ft. and the air space to 360 cub. ft., which is comparable with the small house designs.

There is a very different picture, however, when the design is used with the front open and roof extended forward over the feeding area. If the front is closed to permit the control of ventilation, the air space is 1250 cub. ft., or 125 cub. ft. per pig. This design has proved to be too cold in winter and early spring, particularly when small pigs are housed. The total emission of body heat from small pigs can have no appreciable effect on the air temperature which can be maintained in the house. The provision of a temporary kennel or cover over the sleeping quarters or a restricted part of this area is a satisfactory solution.

For fattening in the warmer months the open-fronted type of house gives reasonably good results, but because of the considerable daily fluctuations of temperature throughout the year it is very doubtful whether results will be as good as those obtained in smaller houses giving more control over temperatures, which, incidentally, are cheaper to construct.

Radical Modification

A radical modification of the "half Danish" type of house has been effected by Mr. J. G. Fowell, of Howick, Auckland. The design is shown in the diagram on page 554. In its original form it provides accommodation for 16 baconers on a total floor space normally occupied by 10 under the typical Danish ground plan layout. The whole house is roofed over, though the feeding race is in the open. Though the air space enclosed is 1200 cub. ft., extra sleeping and trough space bring the air space per pig down to a reasonable 75 cub. ft.

It is not possible on all farms to make effective use of units as large as Mr. Fowell's, but there appears to be no reason why the sleeping quarters and trough should not be reduced by multiples of 2ft. to whatever size is considered suitable. However, this process would decrease the efficiency of the design from the standpoint of air space per pig as the dunging area would represent an increasing proportion of the total air space to be warmed and therefore the air space per pig would increase. With 10 pigs the figure would be approximately 80 cub. ft. per pig.

The design lends itself to a further adaptation which, with an outside dunging race, was the forerunner of the Harper Adams design. This modified design has units of the type of Mr. Fowell's house placed in pairs facing each other across a narrow feeding passage between the troughs. It is worth a trial, particularly on larger establishments where the number of pigs raised makes pens of 15 or 16 baconers practical.

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The above bulletins, part of a series of over 350 on all aspects of farming, are available post free from the nearest office of the Department of Agriculture, or from the Head Office of the Department, Box 2298, Wellington.

Conclusion

The results obtained with the houses discussed in this article, as with the houses described in previous articles in this series, depend very largely on management. The better the pigs do in the housing provided the keener becomes the interest in management. There is considerable evidence that much wasteful food conversion could be prevented by the use of types of houses which enable temperatures to be maintained at levels which give efficient conversion. If management is good, the extra cost of such housing will be recovered in increased production in a very short time.

By the use of some of the more simple designs it is possible to get excellent results with a very reasonable capital cost. Such a design incorporated into a well-planned layout aimed at economising effort in feeding, cleaning, and other general management is the aim of the efficient pig producer.

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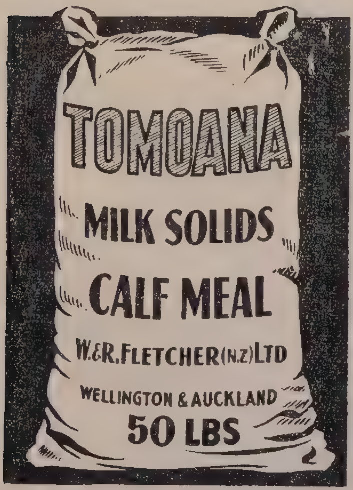

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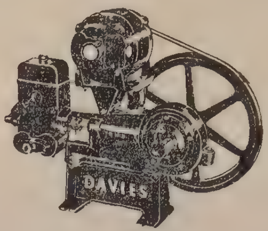

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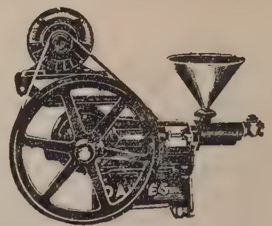

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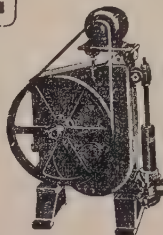

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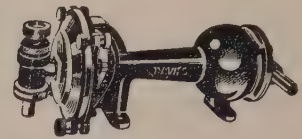

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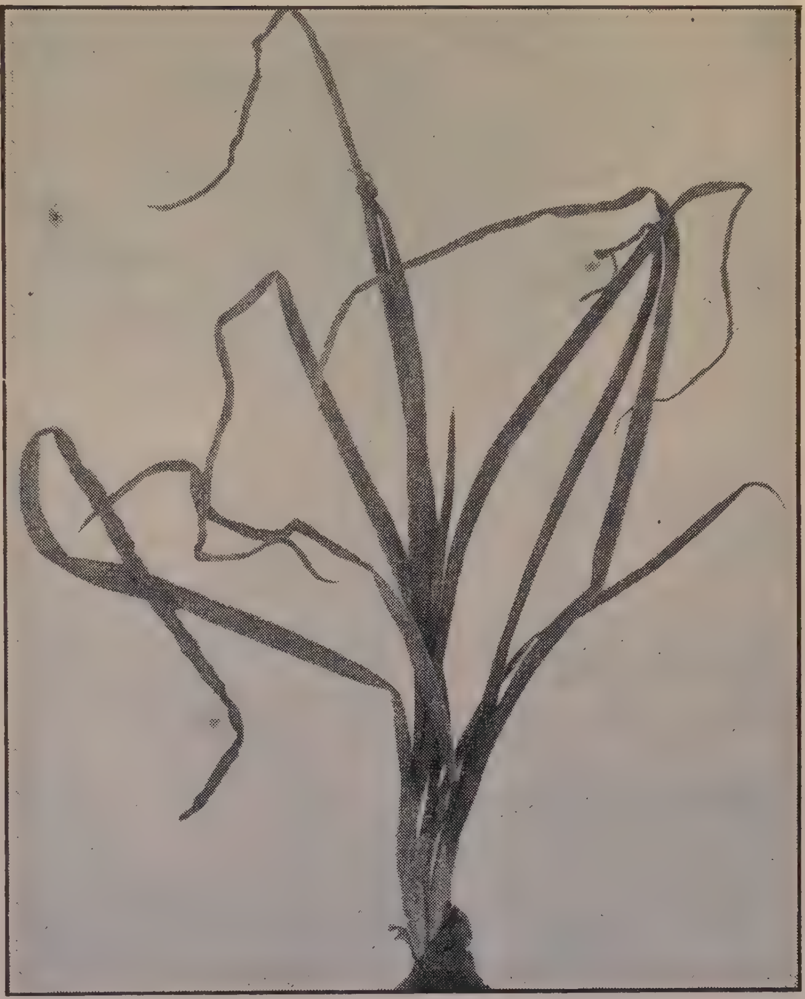
Control of Onion Thrips at Pukekohe

ONION thrips (*Thrips tabaci* Lind.) have for a number of years caused considerable damage to crops in the Franklin district. In some years damage by thrips has resulted in as much as 33 per cent. reduction in crop yield. Control measures have been haphazard, as there has been no reliable information on the effectiveness of different treatments. This article by H. Jacks, Senior Plant Pathologist, and R. A. Harrison, Entomologist, Plant Diseases Division, Department of Scientific and Industrial Research, Auckland, and T. C. R. Dawe, Vegetable Instructor, Department of Agriculture, Pukekohe, describes trials on the control of onion thrips carried out in Pukekohe during the 1951-52 and 1952-53 seasons.

THRIPS tabaci is a minute, slender insect about 1/25in. long. Males, which are wingless, are scarce. Adult females are winged, very active, and produce large numbers of offspring (Fig. 1). Eggs are laid singly in the tissue near the bases of leaves. From these eggs hatch small, yellowish nymphs, the first of four nymphal stages. The first two nymphal stages feed at the bases of the leaves in the throat or chit of the plant, where they are well protected. The last two nymphal stages are passed in the soil at the base of the plant. Adult thrips feed over the entire leaf. The insect feeds by puncturing the leaf surface with its mouth parts and imbibing the exuding sap. Damage to the leaf surface causes white blotches and streaks and lowers the vitality of the plant (Figs. 2 and 3).

The number of thrips generations occurring each season in New Zealand is not known. Records made on trial areas have shown that the minimum time required for adults of a successive generation to appear is 23 days. It would be possible therefore for as many as 6 generations to occur in any one season.



[Department of Scientific and Industrial Research

Fig. 2—An onion plant which has been attacked by *Thrips tabaci*.

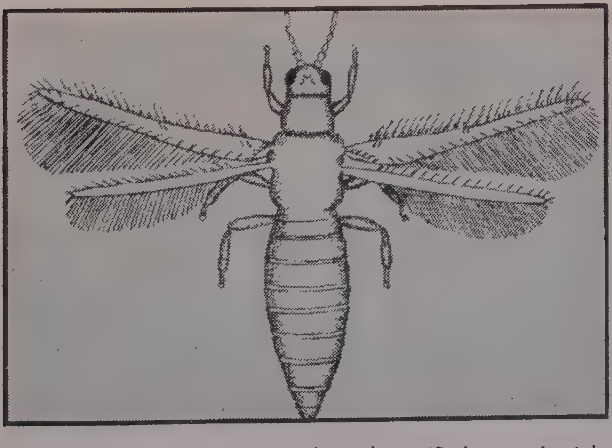


Fig. 1—An adult female onion thrips (magnified approximately 50 times).

Experimental Methods and Results

In the 1951-52 and 1952-53 seasons extensive field tests were carried out at Pukekohe with the object of assessing:—

1. The most effective insecticide, and
2. The frequency of applications required to give adequate control of the pest.

Insecticides used were of three types:—

1. Those having contact effect only; that is, sprays such as nicotine sulphate, H.E.T.P., and T.E.P.P., which kill the insects hit;
2. Those having contact and residual effect; that is, preparations such as "Trimort" D.D.T. emulsion, "Nexa" (lindane) emulsion, "Folidol" (parathion) emulsion, and summer oil, which kill insects at the time of application and for some time after;
3. Those with systemic effect; that is, preparations such as "Isopestox", "Pestox 3", and "Folidol", which are absorbed by the plant and exert their effect on insects sucking the plant sap. Parathion has a contact and residual effect as well as being systemic for a short period.

The composition of the insecticides used in these tests has been given elsewhere.* For some treatments contact insecticides were combined with other types to increase effectiveness.

* Harrison, R. A., and Jacks, H. "Control of Onion Thrips" (Part I: "Preliminary Selection of Insecticides"), "New Zealand Journal of Science and Technology", vol. 34A, pp. 335-338. Jacks, H., and Harrison, R. A. "Control of Onion Thrips" (Part II: "Final Selection of Insecticides"), "New Zealand Journal of Science and Technology", vol. 35A, pp. 164-167.

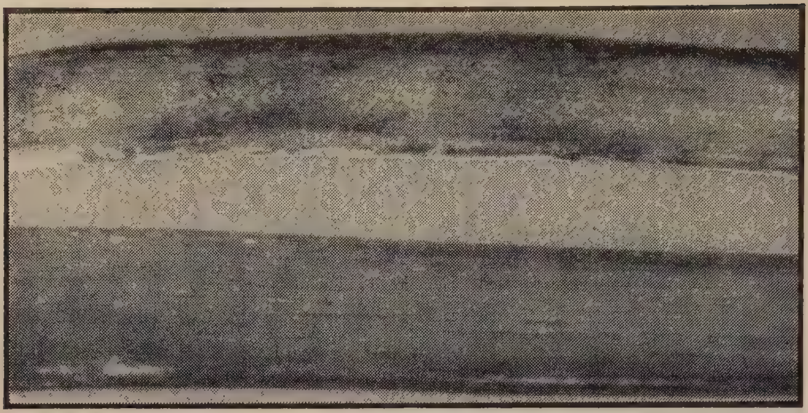


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Fig. 3—Close-up view of a damaged onion leaf taken from the control plots (above) and an undamaged leaf taken from the plots sprayed with D.D.T. emulsion (below).

Trials were laid out to allow applications to be made at intervals of 7, 10, and 14 days respectively. An exception was made with "Pestox 3", which was applied at intervals of 14 and 28 days. Applications of all insecticides were discontinued 2 weeks before harvest.

Plots were amply replicated and dispersed over the trial areas. Records of thrips population were made in November, December, and January.

Results showed that applications at 14-day intervals did not give as great a measure of control as those made at intervals of 7 and 10 days. The most effective materials, expressed as concentrations in 100 gallons, were "Trimort" D.D.T. emulsion (5lb.), "Nexa" (lindane) emulsion (3lb.), "Folidol" (parathion) emulsion (2lb.), "Hexone" (2 pints), "Murphy" T.E.P.P. (1 pint), and "Isopestox" (2lb.). Records of thrips population a month before harvest in treatments applied at 10-day intervals showed an average of 3 thrips per plant in D.D.T. treatments, 16 thrips per plant in lindane, 13 thrips per plant in parathion, 23 thrips per plant in "Hexone" or T.E.P.P., 37 thrips per plant in "Isopestox" treatments, and 62 thrips per plant in untreated checks.

Outstanding effects were obtained with "Trimort" D.D.T. emulsion at 5lb. in 100 gallons of water, and results suggest that equivalent control could be obtained with "Nexa" (lindane) emulsion at 6¼lb. to 100 gallons. These compounds are preferable to others, as they do not involve the health hazards met with in the application of organic phosphorus insecticides such as H.E.T.P. or T.E.P.P., "Folidol" (parathion), and "Isopestox".

Observations over several seasons in the Franklin district showed that depending on weather conditions the thrips population begins to build up some time from the end of November or from the middle of December. Few thrips were seen under cold and wet conditions, but the thrips population began to build up as soon as the weather became fair and warm.

Spraying for control of onion thrips should begin before heavy infestation builds up. To ensure satisfactory results it is recommended that applications of "Trimort" D.D.T. emulsion at 5lb. in 100 gallons be made at 10-day intervals. Depending on weather conditions applications should begin some time during the period from early November to early December and should continue until 14 days before harvest.

Acknowledgment

Thanks are expressed to Messrs. D. and M. McDougall, Pukekohe, for providing onion crops and facilities for the trials reported here.

☆

Book Reviews

"Farm Management": James Wyllie

MANY books on farm management have been written by United States workers in this field, and it is an event to have one written by a British agricultural economist. "Farm Management", by James Wyllie, is obviously the result of many years' study of farm management problems in many parts of England and Scotland, and though some of the ideas are not applicable to conditions in New Zealand, there is much in the book of considerable interest to New Zealand farmers, agricultural research workers, and farm extension workers.

Wyllie begins: "Farm management is concerned with the organisation of the individual farm so that it will yield the highest possible average yearly profit consistent with the maintenance of satisfactory wages and conditions for the workers and the observance of rules of good husbandry". Throughout the book the author regards the farm as a business.

After dealing with such points as the attributes of a good farmer and how some of the basic economic laws apply to farm management the writer has a very good chapter on the various indices which are used to measure farm efficiency, and he shows how care must be taken in their definition and use.

Chapters deal with farm budgeting, capitalisation of farming, and farm mechanisation, and then he covers in some detail the management problems associated with the main farming systems of England—dairying, beef production, sheep farming, pig husbandry, and cropping. These chapters deal essentially with English conditions, but New Zealand farmers will find much in them of interest.

Wyllie's book is a real contribution in the farm management field and he shows clearly how most of the decisions a farmer has to make are essentially business decisions.

—*R.H.S.*

E. and F. N. Spon Ltd., London. 25s.

"A Short History of Wool and its Manufacture": E. Lipson

THIS book will not be of much practical value to the farming community. It should, however, be of great general interest to those who earn a living from sheep and wool and for that matter to most New Zealanders, whose standard of living is inevitably affected by the welfare of their great pastoral industry.

It traces the history of sheep and wool and the conversion of wool to cloth from the Middle Ages. Much of this history is confined to England, which is not surprising, because for centuries England led the world in the production of sheep, wool, and textiles. Appropriate mention is made, however, of the part played by other lands such as Spain with the development of Merino sheep, Flanders with its special cloths and the introduction of the skill required to produce them to England with the Flemish weavers, and the role of Australia and New Zealand in more modern times as the world's great wool producers. Above all the book cannot but impress the reader with the great part that sheep and their wool have played in building Britain and the Commonwealth to their present status.

—*J.E.D.*

William Heinemann Ltd. 12s. 6d.

"Musterer on Molesworth", by Bruce Stronach, is a slim volume recording the author's impressions of a season's work with the sheep on one of New Zealand's largest stations before the war. The prose never reaches the heights attained by the sheep, but it is interesting for all that in its reflections of the reactions of a handful of men in their day to day contest with the extensive and primitive environment in which they work. Whitcombe and Tombs Ltd. 10s. 6d.

Publications Received

"List of Research Workers in Agriculture, Animal Health and Forestry in the British Commonwealth 1953", Commonwealth Agricultural Bureaux Executive Council. 15s.

"New Zealand Flock Book", vol. XLIX, Council of the New Zealand Sheep Breeders' Association.

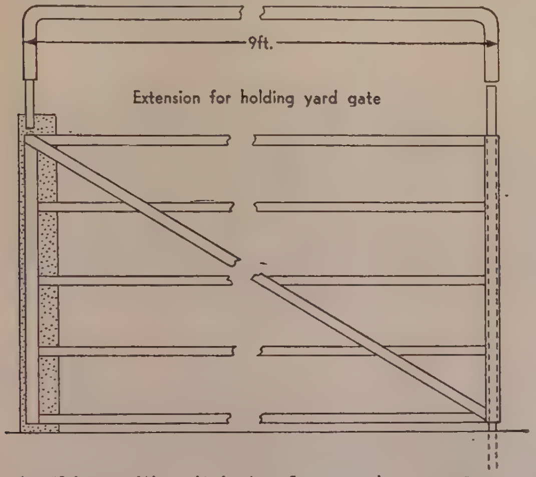
"Better Window Boxes", G. D. Hardwicke. Phoenix House Ltd., London (A. H. and A. W. Reed). 2s. 3d.

Simple Crush for Restraining Dairy Cattle

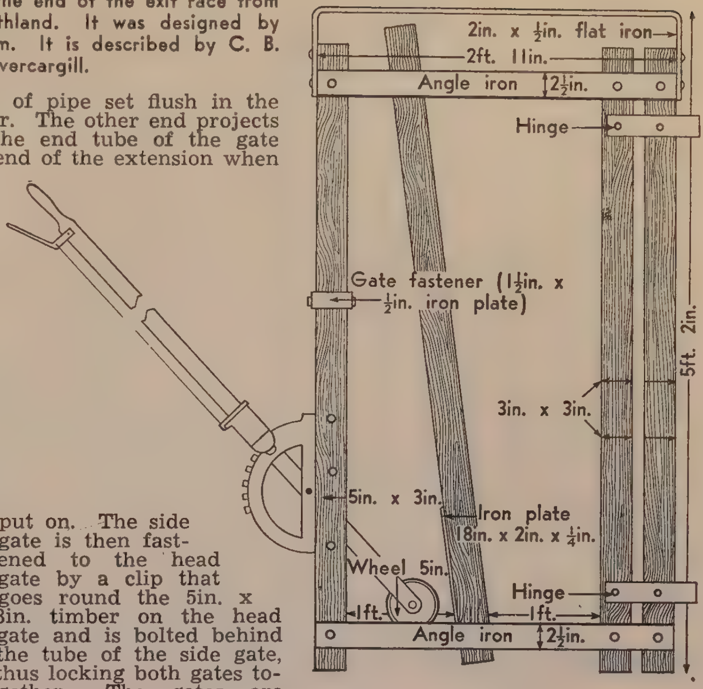
A SIMPLE and efficient crush for restraining dairy cattle during dehorning, drenching, minor surgical operations, and the like was built into the end of the exit race from the milking shed of Mr. C. H. Powell, West Plains, Southland. It was designed by Mr. Powell and constructed from odd material on the farm. It is described by C. B. Atkinson, Special Inspector, Department of Agriculture, Invercargill.

THE head gate of the crush is hinged to a reinforced concrete post in the fence of the exit race. The gate is hung with 3in. centre swing hinges and the pin on the top dog of the hinge is screwed and has a nut on it to prevent the gate from lifting. When the crush is not in use the head piece can be closed back against the fence.

The gate into the holding yard, which is 9ft. wide and 4ft. 8in. high, is opened round parallel with the fence of the exit race, thus forming the side of the crush. When the gate is in this position it is too low, owing to the fall in the race, so an extension on the gate has to be used. This extension is very simple and is designed to slip inside the end post of the gate at the hinged end and over the lock rod at the other end. The extension brings the height of the gate up to 5ft. 3in. at the head end. The side is then fastened into position by a length of pipe passed through the the end tube of the gate and down into a piece of pipe set flush in the concrete floor. The other end projects 6in. above the end tube of the gate to hold the end of the extension when put on. The side gate is then fastened to the head gate by a clip that goes round the 5in. x 3in. timber on the head gate and is bolted behind the tube of the side gate, thus locking both gates together. The gates are hung on reinforced concrete posts 8in. in diameter with all corners bevelled back 2in.



The top angle iron on the inside of the head gate has a recess cut in one end to support the extension of the side gate. The angle irons shown in this design are very essential, as they give stability to the head gate.



Materials

Materials required to build the head gate are as follows:—

Timber: 2 pieces of 4in. x 3in. 4ft. 6in. long, 1 piece of 4in. x 3in. 4ft. 9in. long, 1 piece of 5in. x 3in. 4ft. 6in. long.

4 pieces of angle iron (2½in.) 2ft. 9in. long.

A 5ft. length of 2in. x ½in. flat iron for extension on top of head gate.

A quadrant and ratchet lever off an old set of discs.

A 5in. diameter wheel.

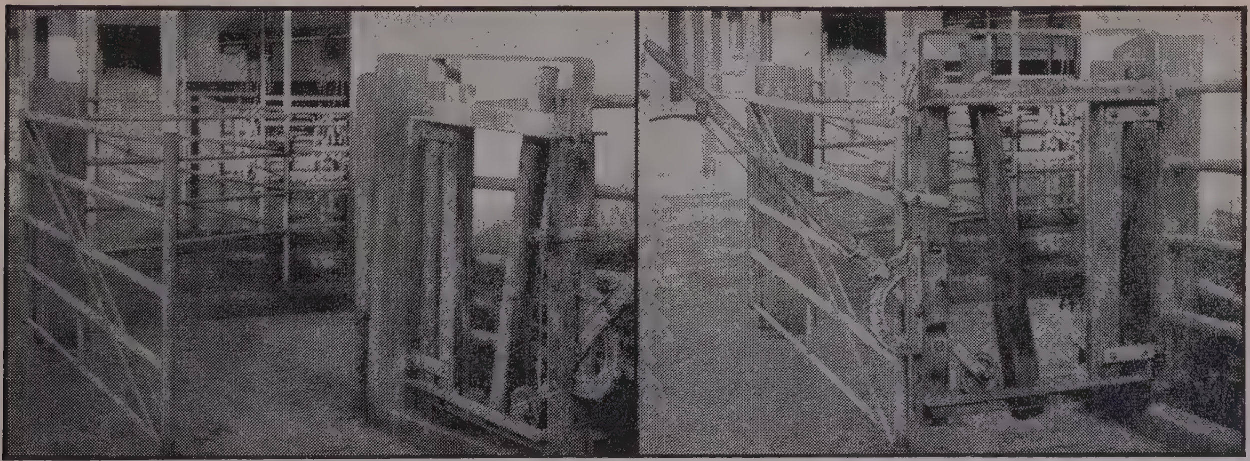
A 1ft. 6in. length of 2in. x ¼in. flat iron for the wheel to run on.

A 1ft. 8in. length of 1½in. x ½in. flat iron to make a gate fastener.

16 5in. x ½in. bolts.

3 5½in. x ½in. bolts.

Details of assembly are shown in the accompanying illustrations.



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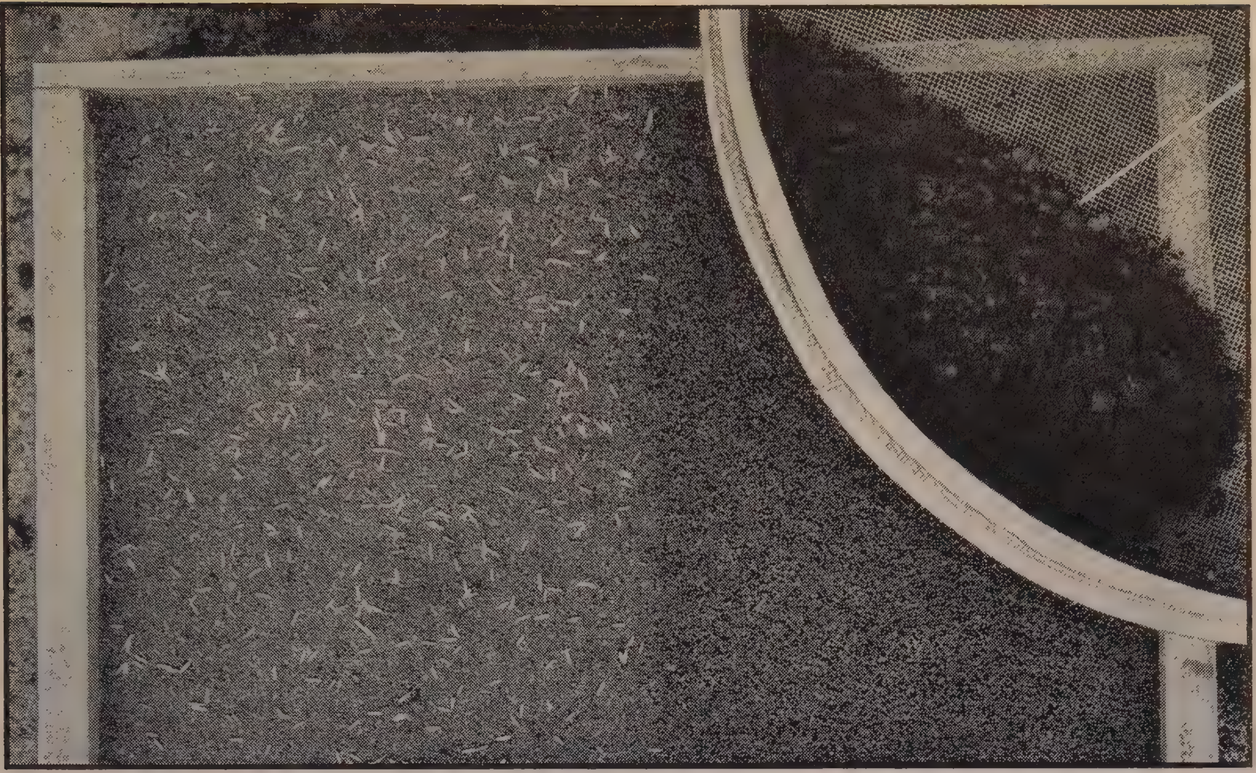


Sowing Seed in Boxes and Pricking out Seedlings for the Home Garden

DURING winter and early spring gardeners will derive great pleasure and satisfaction from raising their own vegetable seedlings in boxes ready to plant out as soon as weather conditions allow. At other times of the year, too, this method will prove to be well worth while. In the first part of this article J. S. Say, Horticulturist, Department of Agriculture, Auckland, explains why home-grown seedlings are preferable and the methods of seed sowing and pricking out. The section of this article which deals with routine work for July is by W. G. Crawford, Horticultural Instructor, Department of Agriculture, Oamaru.

WHEN the home gardener raises his own seedlings he can grow the particular variety and number he requires and can plant them out into the open ground at the most favourable time with little damage to the root system and consequently no check in growth. Bought seedlings, particularly of cabbage, cauliflower, and lettuce, are frequently of unknown variety and often have little root. Usually they are sold in lots of 50 or even 100 plants, but often one or two dozen plants are all that the home gardener needs. By making small sowings at frequent intervals the home gardener can have plants of the most suitable variety for the season and have them coming on in succession.

The chief factors affecting germination of seed are moisture, aeration, and temperature. Moisture softens the seed coat and penetrates to the embryo, which if other conditions are correct, will become active. As oxygen is needed for germination, the seed mixture must be well aerated. The gardener has a very large measure of control over moisture and aeration by use of a suitable mixture for sowing, by careful watering, and by ventilation if seed boxes are in a frame or glasshouse.

As temperature cannot be controlled so easily, especially where a frame or glasshouse is not available, it is essential to sow seed when the temperature is favourable. Disappointment is often caused by sowing seed too early in an attempt to get an early crop. It is far better to wait a few weeks until the temperature has risen.

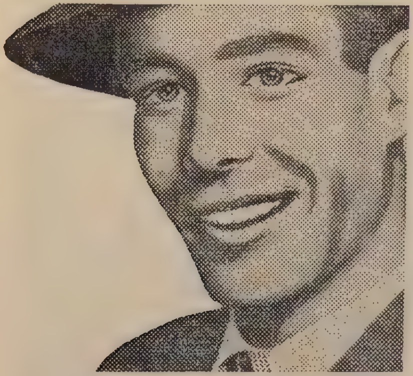
Though generally it is recommended that the gardener raise his own seedlings, it is sometimes an advantage to buy tomatoes for early planting if there is a warm, sheltered position for them. To buy plants which are fairly soft and plant them out in an unprotected place is to court trouble. When buying tomato plants the gardener should take care to get only strong, stocky plants of a good green colour.

Preparing Seed Sowing Mixture

Most gardeners have heard of the John Innes composts, which are excellent when prepared correctly. Unfortunately the mention of peat, chalk, and hoof and horn in the John Innes mixtures rather deters the home gardener who cannot obtain these ingredients. However, good substitutes are leaf-mould or compost for peat, agricultural lime for chalk, and blood and bone for hoof and horn. Peat and hoof and horn are on the market, but are not readily available yet.

When correctly made John Innes composts require a sterilised soil. Peat and sand, being sterile, do not require treatment, but as it is not advisable to sterilise leaf-mould or compost by steam, it is of no advantage to use sterilised soil with those materials. Usually, damping off (infection with parasitic organisms) is not serious with vegetable seedlings in the home garden, but to ensure freedom from this trouble, the seedling mixture may be disinfected with formalin. For effective results the mixture must be thoroughly saturated with a 2 per cent. solution (1 part of 40 per cent. formaldehyde to 50 parts of water) and covered with sacks for 48 hours. When these have been removed the soil should be turned several times to get rid of fumes.

HEADING PHOTOGRAPH: Seed should be sown thinly and evenly by shaking it gently from the packet. It should be covered with soil put through a ⅛in. sieve.



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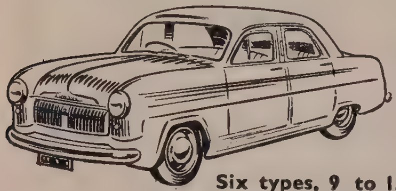

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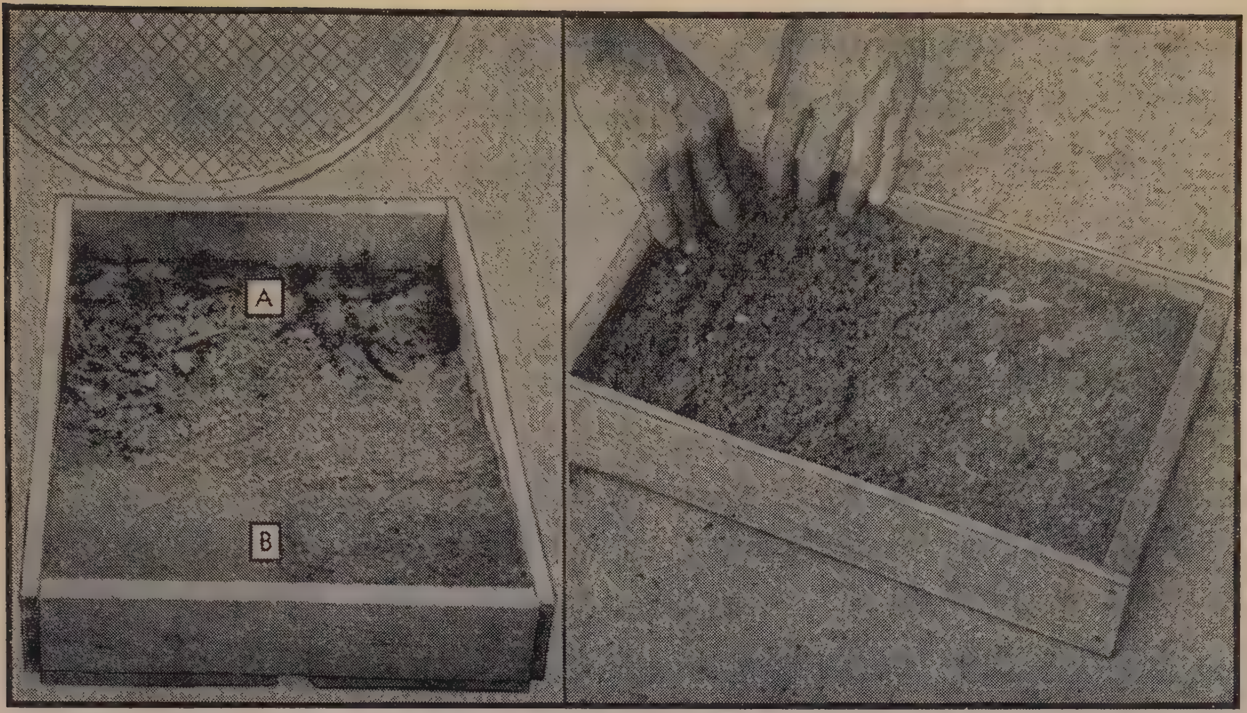

[Photo at right by Photo News

Left—Coarse leaf-mould or compost (A) is placed in the bottom of the box to permit drainage and the sieved seed mixture (B) used at the top for sowing the seed in. Right—After the box is filled the mixture should be firmed with the fingers, particular attention being paid to the corners and sides.

When these have dissipated the mixture may be used.

A good seedling mixture can be made up as follows:—

2 parts (by volume) of good garden loam

1 part of leaf-mould or compost

1 part of coarse sand

¾oz. of lime and 1½oz. of superphosphate per bushel of mixture (an apple case contains about 1 bushel)

The leaf-mould (or compost) and sand play a very important part in the seed mixtures in providing suitable conditions for germination. The leaf-mould or compost acts as a conditioner. It helps aeration by preventing the soil from packing down and it regulates the supply of moisture, both by allowing good drainage and by acting as a reservoir of moisture. Coarse, sharp river sand should always be used, but where this is unobtainable fine screenings from gravel or scoria may be used. Its part in the seed mixture is to help drainage and aeration.

The loam and compost should be sieved through a ¼in. sieve and the lime and superphosphate through an ⅛in. sieve. The ingredients should then be mixed thoroughly. The most satisfactory method of mixing is to spread out the loam in an even layer, then to spread the compost evenly over the loam, and finally to spread the sand over the heap and sprinkle the lime and superphosphate over the sand. The heap should be turned at least three times. If the loam is dry, it may be necessary to add water. This is best done with a can as the mixing proceeds. After mixing, the compost should be of a consistency that will just hold together when squeezed in the hand.

Not infrequently the soil from the garden used for the seed mixture contains a large number of weed seeds, which will compete with the vegetable seeds as they germinate. If the seedling mixture is made some weeks before it is needed and turned occasionally, the weeds will be destroyed

Firming seed box soil with a float. The soil should be left perfectly level and about ½in. below the top of the box.

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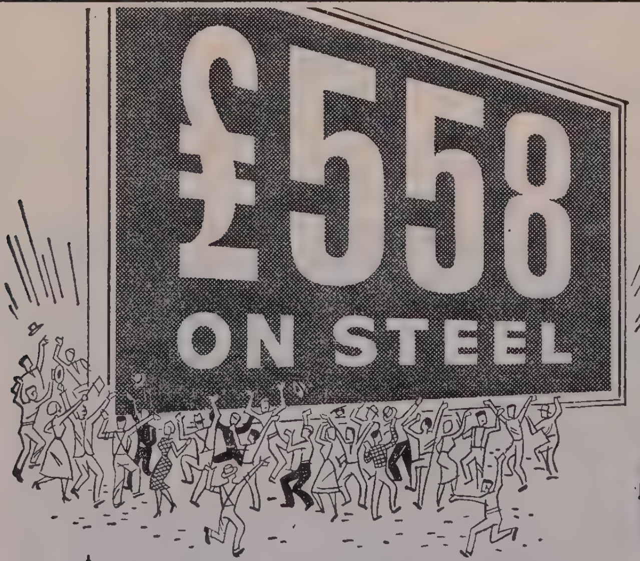

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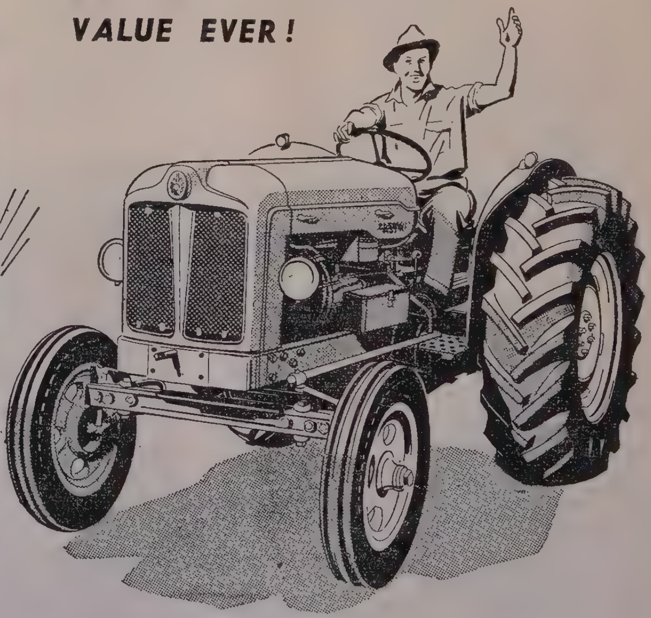

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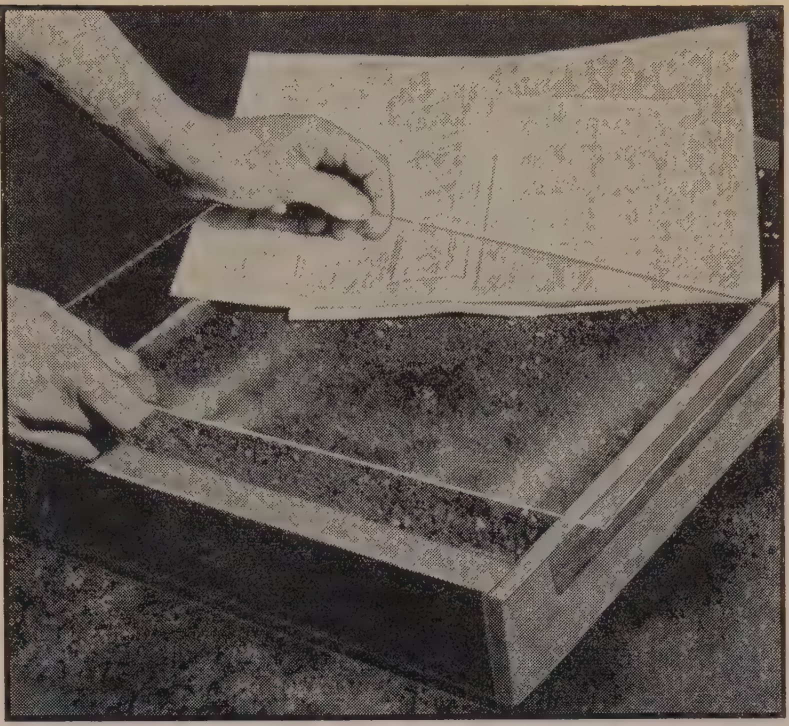
as they germinate. Care must be taken that the mixture does not dry out during this period.



[*Sparrow*

Glass and newspaper being placed over the seed box to assist germination and to hold moisture.

Box for Seedlings

A box about 3in. deep is suitable for seed sowing and can be of any convenient size; anything larger than 14in. x 20in. is rather cumbersome to handle. Good drainage is most essential and for this reason the boards on the bottom should be about ¼in. apart. About 1in. of coarse (unsieved) decomposed leaf-mould or compost should be placed in the bottom of the box to provide drainage. Coarse rubble left in the sieve when the loam is put through may also be used. Compost or leaf-mould which is only partly decomposed, grass clippings, and straw are unsuitable and should not be used.

The best method of preparing the box for sowing is as follows: Fill the box almost to overflowing with the mixture and roughly level it off. Press this down with the fingers, which should be spread slightly apart. Go over the whole box in this way, paying particular attention to the corners and sides. After this roughly level off the top with the hands, add more of the mixture if necessary, and level off finally by tamping down lightly all over the surface with a float: Two points must be carefully watched when the boxes are being filled. The surface must be perfectly level and the soil must be evenly compacted. If some parts are looser than others, they will sink when watered and the seed will wash down into these low places. The same will happen if the soil is not level at first. The final level should be about ½in. below the top of the box.

Sowing Seed

Seed should be sown thinly and evenly over the whole surface of the mixture. This can be done by shaking it gently from the packet or by sprinkling pinches of seed held between thumb and fingers. This broadcast sowing is more satisfactory than sowing in drills for a number of reasons: Roots have a freer run and do not get intertwined and are therefore damaged less during pricking out. As the tops have a greater area in which to spread, they are less likely to become drawn and the danger of disease is also lessened. If two or more varieties are to be sown in the one box, parts can be covered with a piece of glass or paper, which can then be moved over the sown part. To avoid any confusion each section should be labelled as soon as it is sown.

After the seed has been sown it should be covered lightly by some of the seed compost sieved over it through an ⅛in. sieve. It is usual to cover the seed to a depth equal to its own diameter. Very fine seed does not need to be covered. Compost in suitable condition should not need to be watered immediately after sowing, but if it is at all dry, water should be applied with a can through a very fine rose, or the box should be stood in an inch or two of water until water soaks up to the surface.

Future Treatment

Future treatment depends largely on the facilities available. If the box is to be stood in the open, it should be placed in a warm, sheltered situation, raised from the ground, and covered with a piece of frosted glass or clear glass covered with a piece of thin scrim. One edge of the glass should be raised so that rain runs off.

Where a frame or glasshouse is used the box should be covered with glass and a piece of newspaper. During summer shading will also be necessary on the glass of the frame or house itself. Scrim blinds are ideal, as they can be raised and lowered as necessary, but shading with whitewash is suitable.

The glass covering the boxes should be turned every day to get rid of condensed moisture. As soon as the seeds begin to germinate the glass should be raised slightly, and when all are germinated it can be removed. In the early stages after this seedlings growing in the open are better kept out of full sunshine, as the surface of the soil dries out very quickly. Even if the seedlings do not suffer from lack of water, they may become burnt in very hot weather. On the other hand too much shade will cause them to become drawn. A position where they receive the dappled shade of trees is good as long as they do not receive drips during wet weather.

Damping off, should it appear, can be checked by the use of Cheshunt compound, but though this will help to prevent its spread, it will not cure affected plants.

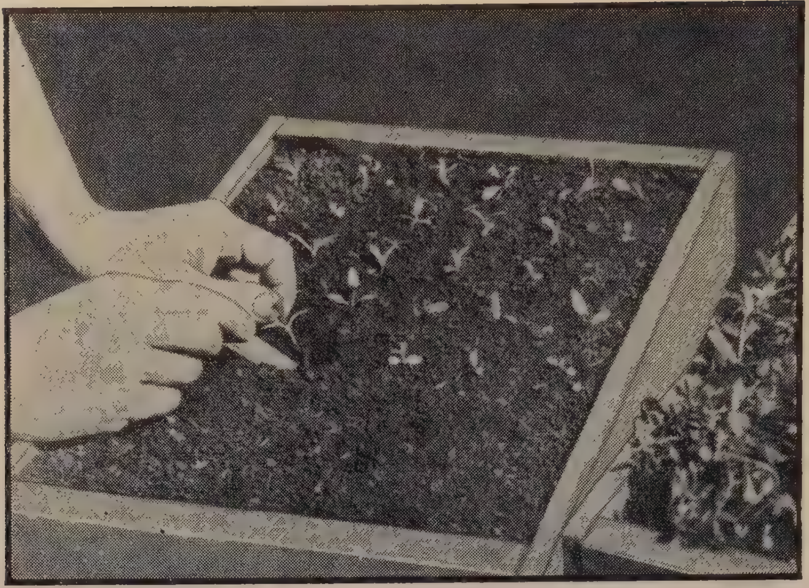
It is unlikely that diseases other than damping off will be met with, but several pests may become troublesome. Cabbages and cauliflowers are particularly liable to attack by caterpillars, which can be controlled by spraying with arsenate of lead or D.D.T. Slugs and snails may be dealt with by metaldehyde baits, but the primary method of dealing with them should be good garden hygiene. The area where seedlings are being grown should be free from weeds and rubbish which may harbour them.

Pricking out

Pricking out is the term given to the transplanting of seedlings into fresh soil at a very early stage of growth. Though it may be looked on as a laborious procedure, it is essential if good seedlings are to be grown. Crowded seedlings will soon exhaust the supply of plant food, their roots become intertwined, and in the struggle among plants for light and air their tops will become drawn. Crowded conditions also encourage pests and diseases. By pricking seedlings out into a slightly richer mixture than that used for sowing and giving them plenty of room to develop, strong plants will be obtained. Usually seedlings develop a long taproot in the seed box, but after pricking out they develop a mass of fibrous roots, and at planting out time it will be possible to lift the plants with a good ball of earth attached.

Pricking out should be done as soon as the seedlings are large enough to handle. On no account should it be delayed until the seedlings have become drawn. As very little damage is done to the roots when seedlings are pricked out at an early stage, plants receive little check to growth. Seedlings should be watered some hours before pricking out so that the soil is moderately moist.

The boxes into which they are going to be pricked out should be prepared in a similar way to that described for seed sowing. The same mixture with the addition of 1½oz. of blood and bone to the bushel should be used.



[*Sparrow*

Seedlings should be pricked out as soon as they are large enough to handle. They should be held by the leaves to avoid bruising the stems. The outside rows are planted well inside the box to allow sufficient room for root development.

Pricking out is very simple. The seedling is held by a leaf (never the stem, which is liable to bruise) and with a dibble gently lifted from the soil. Then with the dibble a hole is made in the new compost, the seedling inserted, and the soil firmed gently round it. A suitable spacing is 2in. x 3in. Usually the seedlings are set at the same level as they were in the seed box, but plants with long stems, such as cabbages and tomatoes, may be set a little deeper. If plants are at all leggy, they must be set deeper, but the crowns of lettuces and plants of similar growth should never be covered.

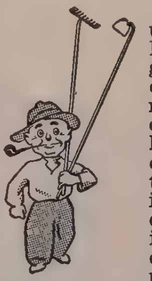
Watering and Hardening off

If the seedlings have been raised outside, they should be placed in a sheltered position out of the sun and wind and watered. Until they are established they should be given a light spray with water over the tops several times during the day if the weather is hot and drying, and the boxes should be given a thorough watering whenever necessary. No set rules can be given as to the frequency of watering, as this varies greatly with weather conditions. Once the seedlings are established they can be moved into a more open situation.

Where seedlings are to be replaced in the glasshouse or frame where they were raised a little additional shading may be necessary for the first few days, and draughts from side ventilators should be avoided. Later the ventilation may be increased until they can stand full ventilation under normal weather conditions.

As soon as seedlings approach the size when they can be planted out in the open they should be hardened off by being placed outside in a sheltered, semi-shaded position. After a few days they can be moved into a position in full sunshine. Two or three weeks later they will be ready for planting out in the garden.

Work for July



In July the weather is usually such that very little can be done in the garden except, perhaps, digging and general maintenance work. However, at this time the home gardener gets an opportunity for doing those odd jobs which it is inconvenient to do during the busy gardening season. He can check over gardening tools, paint and repair broken fences or trellises and seed trays, and dig over all the parts of the garden not carrying a crop.

The home gardener does not require an extensive range of tools, but those that he needs represent quite a few pounds in money and should be kept in good condition. Garden tools will only do good work if they are given the proper care. All garden tools should be overhauled before the spring starts. Rust should be removed by rubbing the metal hard with a wire brush, emery paper, or with an old cloth dipped in oil and fine sand after soaking the corroded portions in kerosene for a few hours. Fish oil painted on to metal surfaces prevents corrosion. A thin layer of grease or old motor-car oil will also prevent rust from forming during the off season.

Wooden handles should be kept clean and smooth by giving them a good rubbing with fine glasspaper occasionally, followed by a light rub over with an oily cloth, which makes the handle bright and helps to preserve the wood.

All cutting tools, such as hoes and spades, should be kept sharp for efficient working. A flat 8in. or 10in. file with one side coarse and the other fine is a good sharpening tool.

Gardeners should make a habit of cleaning all tools well after each day's use. The metal portions should be rubbed over with an oily cloth and the tools hung on hooks or nails inside a shed.

Cultivation

The garden should be cleared of all exhausted crops and vacant ground dug and manured. Sandy soils usually dry out fairly rapidly, but heavy soils should not be dug when wet or sticky. Deep or double digging should be done at this time of year and not left until spring. Though deep digging can be very beneficial, great care must be taken to see that subsoil is not brought to the surface. Many gardens have been spoiled for a season or two by this practice. The subsoil should be loosened if necessary, but not brought to the surface.

Farmyard manure, compost, lawn clippings, or any other organic materials available are better worked into the surface soil now than in spring. If this is done, a light digging in spring is all that is required then. Only well-rotted manure should be used in spring.

Sowing and Planting

Except in warm districts or in a few very favoured localities elsewhere nothing is to be gained by sowing or planting vegetables during July. In the main, sowing and planting are much better delayed until August, when soils are becoming warmer and there is a reasonable chance of seeds germinating and plants coming into growth quickly. Any conditions which hinder the vigorous development of the plant will tend to bring about a premature bolting to seed.

One or two of the more hardy vegetables can be put out in favoured localities, particularly if the soil is sandy and inclined to dry out readily.

Broad beans can be sown on well-drained soils. Good varieties are Broad Windsor, Long Pod, and Coles Dwarf.

Spinach: Prickly-seeded is a good variety of spinach to put out during this month in well-drained loams or sandy soils.

Radish and spring onions: These can be sown only in the most favoured localities and when the soil receives a good deal of winter sunshine. Good varieties are French Breakfast and White Icicle (radishes), and White Lisbon (onions).

Sowing under frames: Lettuce, cabbage, and cauliflower can all be sown under cool frames for setting out later. Suitable varieties are:—

Lettuce: Neapolitan (winter strain) or Imperial 615.

Cabbage: Flower of Spring, Golden Acre, or Hendersons Succession.

Cauliflower: Early London or Early Walcheren.

Winter Show Dates

THE following are the dates and venues of winter shows:—

*15, 16, 17, 18, and 19 June—Taranaki Metropolitan A. and P. at New Plymouth.

17, 18, and 19 June—Te Kuiti and District at Te Kuiti.

29 and 30 June; 1, 2, and 3 July—Whangarei A. and P. Winter Exhibition at Whangarei.

* The Department of Agriculture exhibit will be staged at this show.

Feeding Methods for the Household Poultry Keeper

THE question of how and what to feed to obtain the best results is commonly raised by household poultry keepers. Many, of course, wish to incorporate house scraps such as bread, potatoes, and stale milk in the ration; others, possibly through having other animals to consume the scraps, wish to feed only the orthodox poultry foods, mash and grain. In this article H. K. Mullins, Poultry Instructor, Department of Agriculture, Hastings, discusses the various methods by which the household poultry flock can be fed successfully and economically.

THERE are no hard and fast rules for feeding poultry. A number of systems tried in the past have given good results. Mash, either wet or dry, with wheat or grain has proved the most popular with poultry keepers in New Zealand.

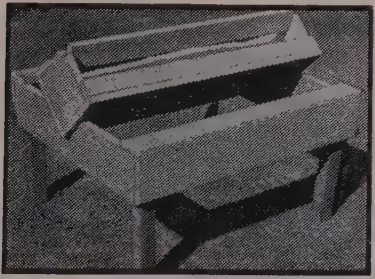
Another method of feeding which is gaining in popularity is all-grain feeding with free meat meal in front of the birds at all times. Naturally the method adopted will be influenced largely by the circumstances. Poultry on a dairy farm, for instance, will no doubt receive a considerable amount of milk or curds in their diet; others in a wheat or maize growing area may have these grains preponderate in their diet. The main factor in securing good production is to ensure that the birds are fed a well-balanced diet of good-quality food. Bread and potatoes, for example, are quite suitable to incorporate in the diet of any small flock, but an excess can result only in the birds becoming too fat, with a corresponding fall in production. This applies particularly to birds confined to a small house where room for exercise is rather limited.

Methods of Feeding

The feeding of a wet mash in the morning followed by greens at midday and grain in the evening is still probably the best method for household poultry keepers. This permits the scraps to be incorporated in the mash, thus providing an appetising but economical feed. Wet mash feeding also eliminates waste. The usual practice is to feed as much mash as will be eaten by the birds in about 20 minutes. This will provide ample food for timid birds which stay on the outskirts of the trough waiting for the more robust birds to move off. In addition, the encouragement of vermin such as rats and mice will be cut to a minimum. The only food that may possibly be left available to rats would be meat meal fed on the ad lib. system. The hopper containing the meat meal should, however, have a suitable lid which can be closed at night and opened again when the birds are fed in the morning.

[*Fraser Niederer*

A V-shaped trough suitable for moist mash feeding.



A type of dry mash hopper suitable for small units of laying birds. The wooden spinner prevents the birds getting into the mash and scratching it out on to the floor.

Dry mash feeding undoubtedly saves a substantial amount of labour, so that even if production was slightly lower, it is possible that the method would be just as profitable as feeding with wet mash, particularly on commercial establishments. However labour-saving dry mash feeding may be, this is not a factor which really concerns the owner of a flock of 7 to 10 birds. Where dry mash is fed it is advisable to keep meat meal in front of the birds at all times. Fish oil, which is used to supplement the vitamin A content of the diet, can be mixed in the grain and fed in troughs.

Another system which is gaining in popularity is the feeding of all grain to the birds. Barley, wheat, or maize fed twice a day in the litter or where desired in hoppers gives excellent results. Meat meal fed ad lib. with greens at midday provides an easy and successful method of feeding the flock. If the grain is fed into the litter, the floor will not cake and the birds will receive a maximum of exercise. The hopper system is ideal for use by household poultry keepers who are away from home all day, particularly in winter, when it grows dark early.

Greenfeed

An abundance of succulent greens is essential for poultry whether they are kept commercialy or not. For household poultry keepers one of the easiest greens to grow is silver beet. When planted in October these plants will grow prolifically during spring and summer provided a reasonable amount of moisture is available.

Grass clippings are quite good feed while the grass is young and tender, but have little value during summer. During late summer and winter it is advisable to supplement the vitamin A content of the diet with a good-quality fish oil. This can be added to the mash or mixed in with the grain at the rate of 3 tablespoons to each 10lb. of meal. As fish oil loses approximately 70 per cent. of its goodness in 10 days when exposed to the air, care should be taken that the tin containing the oil is kept airtight and in a cool temperature at all times when not in use.

Value of Milk

The value of skimmed milk is still not fully appreciated by poultry keepers. Milk has a greater food value than that provided by its chemical constituents, as it appears to help most other foods to be more easily digested. Skimmed milk or milk powder may be used for fowls of any age as long as it is an economical food. Where skimmed milk is plentiful a popular method is to feed the curds to the poultry and retain the whey for pigs. The curds should be dried off with a little mash before being fed to poultry, and in this way much more milk can be fed as a supplementary food. This method is of value, perhaps, only on a dairy farm or where supplies can be obtained cheaply. A warning is, however, necessary in respect to milk. When it is given to chickens to drink, fresh water should also be available, as milk is more of a food and is not a complete thirst quencher for young chicks. In addition scouring may occur when milk alone is given to very young chickens.

Care of Livestock during July

Contributed by the Animal Research Division

PULPY KIDNEY IN LAMBS

WHERE pulpy kidney occurs in lambs under 6 weeks of age its incidence can be reduced by vaccinating the ewes before lambing. If ewes have never been vaccinated before, best results will be obtained from 2 doses of vaccine given at least 1 month apart. Ewes which were vaccinated last year will require only 1 vaccination. The last (or the only) vaccination should be given about a fornight before lambing and this can be done quite safely if ewes are handled carefully. Very poor immunity results where the ewes are vaccinated much earlier. If most losses from pulpy kidney occur in lambs over 6 weeks of age, vaccination of ewes is of no value, but vaccination of lambs at marking may help.

BLOOD POISONING IN EWES AND LAMBS

Losses from blood poisoning in lambing ewes and marked lambs can be greatly reduced, if not eliminated, by vaccinating the ewes with blackleg vaccine about a fortnight before lambing. As the immunity which passes from the ewe to the lamb in the first milk does not persist for many weeks, lambs should be marked early. To obtain the best results it may be necessary to divide the ewes into early and late lambers, which should be vaccinated separately before lambing. Advice concerning vaccination can be obtained from any office of the Department of Agriculture. Where possible ewes should lamb in clean spelled paddocks, and lambs should always be marked in clean temporary yards. Sometimes losses from blood poisoning occur in lambing ewes that have not been vaccinated. If losses are occurring, it is too late to vaccinate. It may be possible to save some ewes by treating them with penicillin if the penicillin is used early enough. It is important that blood poisoning be confirmed, and the local veterinarian should be consulted in this matter. After such confirmation all ewes which are assisted in lambing should be treated by penicillin injection. This should be an emergency measure and should not replace vaccination, which is the cheapest and most certain means of treating blood poisoning.

SLEEPY SICKNESS IN EWES

Heavy losses from sleepy sickness sometimes occur in ewes carrying twins or heavy single lambs. These losses may be prevented by ensuring that ewes do not suffer a check just before lambing. If necessary, ewes should be divided into early and late lambers and drafted on to the best feed available 3 to 4 weeks before lambing. Research has shown that poor feed for 5 weeks before lambing can reduce the fleece weight by more than ½lb.

RINGWORM IN CALVES

Ringworm in calves is sometimes troublesome, especially in poorly nourished calves. Before any remedy is applied the scales should be removed by rubbing in a mixture of equal parts of soft soap and lard and scraping off the softened scabs the next day. The bare patches should then be dressed with an ointment consisting of 1 part of salicylic acid and 8 parts of lard or any registered stock remedy for ringworm which is available. As the infection can be transmitted to man, it is wise to wear rubber gloves when treating ringworm. In any case the hands and arms should be thoroughly washed immediately after the dressings are applied.

ERGOTISM IN CATTLE

Hay made from ergotised grass will cause lameness and sometimes even loss of feet in cattle. The small black ergots which replace the seeds of ryegrass and other grasses can easily be seen, and if they are present in large numbers, the hay should not be used. Similar trouble often occurs when cattle are grazed on tall fescue grass even when no ergots are present. This grass should be regarded as poisonous and should not be grazed by cattle.

WINTER FEEDING OF COWS

It is imperative that cows should be well fed for 6 to 8 weeks before calving. They should have access to hay at all times, and if the pasture is poor, they should also receive up to 20lb. of silage per day. Early calving cows should be given about 2 hours' grazing per day on autumn-saved pasture and in addition should be fed as much silage as they will eat.

MILKING METHODS ARE IMPORTANT

At the start of a new season cows should be trained to let down their milk quickly and completely by the establishment of a fixed milking routine so that the cows are brought into the shed, bailed up, washed, and milked in the same way at each milking. Anything which upsets the cows must be avoided. A brief but vigorous wash followed by the withdrawal of a squirt of milk from each quarter into a strip cup is the best method of stimulating the flow of milk. This will also help in detecting cases of mastitis early. As the duration of let-down is limited, cups should be put on immediately after the washing and starting process. A good milk-flow indicator should be used, and as soon as this shows that milk flow has slowed to ½lb. per minute the cups should be pulled down until milk flow again falls to this rate, when they should be removed at once. Massaging of the udder while the cups are pulled down should be practised only with cows which are known to need it.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during April and for the 9 months ended 30 April 1954, with comparative figures for the same month and 9-monthly period of 1952-53, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

	Tons			Percentage
Period	Creamery	Whey	Total	Inc. or dec.
April 1954	6,974	216	7,190	—
April 1953	8,266	229	8,495	—
Increase or decrease ..	—1,292	—13	—1,305	—15.362
9 months ended 30/4/54	138,560	2,876	141,436	—
9 months ended 30/4/53	155,322	2,963	158,285	—
Increase or decrease ..	—16,762	—87	—16,849	—10.645

Butter in store at 30 April 1954 was 17,769 tons

CHEESE

	Tons			Percentage
Period	White	Coloured	Total	inc. or dec.
April 1954	7,443	28	7,471	—
April 1953	7,847	6	7,853	—
Increase or decrease ..	—404	+22	—382	—4.864
9 months ended 30/4/54	93,008	187	93,195	—
9 months ended 30/4/53	95,946	140	96,086	—
Increase or decrease ..	—2,938	+47	—2,891	—3.009

Cheese in store at 30 April 1954 was 12,913 tons

If these figures are converted into butterfat equivalent, there is a decrease of 9 per cent. in butterfat graded for the 9 months as compared with the corresponding period of the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place from time to time they are not necessarily a true indication of production trends.

Preparing Land for Spring and Summer Sown Crops

Seasonal Notes by the Extension Division

EXCEPT on light soils and in the warmer areas of the North Island, where winter fallowing encourages such twitch-like weeds as browntop and *Poa pratensis*, early ploughing in late autumn or winter is the first step in the preparation of a satisfactory seed-bed for spring sown crops. The longer the period of preparation is the more opportunity there will be for the timely working of the soil. If, however, the ploughing is not done until spring, poorly prepared and weedy seed-beds often result from the insufficient or untimely working. Early ploughing also makes full use of the weathering action of frost, wind, and rain and greatly reduces the amount of working in spring.

PLOUGHING UP GRASSLAND

IF grassland is deep ploughed in late autumn or winter, repeated discings on the inverted sod are required in spring before a satisfactory seed-bed is obtained. Ploughing later increases this difficulty. It is good practice to disc, grub, or skim plough the turf at least 6 weeks before deep ploughing. Air is necessary for turf rotting, and a few weeks' working at this stage would be equivalent to months under the sod. The turf mixture should be thoroughly disced before deep ploughing.

BROWNTOP TURF

Grasslands which contain much twitch-like grass such as browntop require special treatment. Browntop turf forms a deep mat which breaks down slowly in the soil because of its low nitrogen content. It is therefore desirable to have a fairly long period under fallow before sowing in spring. In higher rainfall areas such as Southland the swamp plough is favoured to turn a wide furrow flat to a depth of 7in. to 8in. The digger plough has given good results with browntop turves in Canterbury, as it leaves the soil broken throughout winter and saves much work in spring. If a digger plough is not available, a mouldboard plough can be used to plough to a depth of 6in. to 7in. after the land has been hustled with a stiff-tined cultivator.

FINAL SEED-BED PREPARATION

Heavy soils, especially clays and clay loams, should be worked only when in a suitable condition; they should be neither too wet nor too dry. It is sound practice to begin early spring work on winter-fallowed land with the cultivator, especially the spring-tined cultivator, to mix the turf and organic matter throughout the ploughed depth. Later workings with harrows, discs, or roller should aim at pulverisation, consolidation, weed control, and moisture retention. It should be remembered that the light, silty soils may easily be worked too fine by surface cultivation. Small-seeded crops like rape and turnips require a firm, fine, and moist seed-bed; larger-seeded crops like the cereals require the fineness below the surface. Spring is the time of greatest weed growth, and while the seed-bed is being prepared it is a splendid opportunity to kill thousands of weeds by fortnightly harrowings just before sowing.

—*S. H. HENRY*

* * *

NITROGENOUS FERTILISERS

ON dairy farms where insufficient autumn-saved pasture is available consideration may be given to stimulating pasture growth in early July by the use of nitrogenous fertilisers, which will assist the maintenance of a high level of nutrition for milking cows in early spring. Nitrogen acts in varying degrees according to temperature and weather conditions, and if it is applied when conditions are cold, dry, and frosty, there is a delayed response because of growth inactivity of the grasses. It is therefore necessary to apply quick-acting nitrogen during periods of rather mild, showery, or wet weather to obtain maximum benefits within a few weeks. Applications should be made 4 to 6 weeks before the estimated requirement of this stimulated grass growth. To make full use of nitrogenous fertilisers it is essential to choose fields which are well drained, in good heart, with an adequate supply of phosphate, lime, and potash, and having a pasture with a high percentage of ryegrass. Especially suitable are fields where short-rotation ryegrass predominates, because of its ability to grow quite prolifically at this time of year if the weather is reasonable. The nitrogen should be applied with other fertilisers (superphosphate and potash if they are necessary) according to soil type and should be applied to pasture where the growth is 2in. to 3in. high. The stimulated grass growth should be rotationally grazed for efficient utilisation.

—*R. B. GORDON*

* * *

DRAINAGE WORK

INCLUDED in the many thousands of acres of wet country requiring drainage for successful farming are extensive areas where heavy clay overlies compacted shingle and clay. This is difficult land to drain properly. As is the case with all country having a clay subsoil, moling is the most satisfactory method of achieving good drainage. Much of this country is relatively flat, however, and to provide adequate outlet from the mole drains it is necessary to install a system of tiles into which the moles may discharge.

Hand labour has been required in the past for this arduous task, but today there are available relatively light and highly mobile hydraulically operated back-acting shovels which make light work of the job of digging the tile drains in these stiff and stony subsoils. The maximum benefit from work of this nature is possible only where a complete survey of the area it is proposed to drain is undertaken. From the survey a system of tile and mole drains can be designed to give really good drainage. The method employed in digging to predetermined grades with the back-acting shovel is to establish the depth of the trench at regular intervals and true up the grade with the aid of boning rods. The intelligent use of the back-acting shovel can make the task of truing a comparatively light one. Care is required in the laying of tiles. Before back filling is carried out it is advisable to "blind" the tiles well to safeguard them against damage from large stones or pieces of ironstone. Mole draining is carried out in the normal manner, the tile drains being used as outlets for the moles.

—*E. W. S. WILSON*

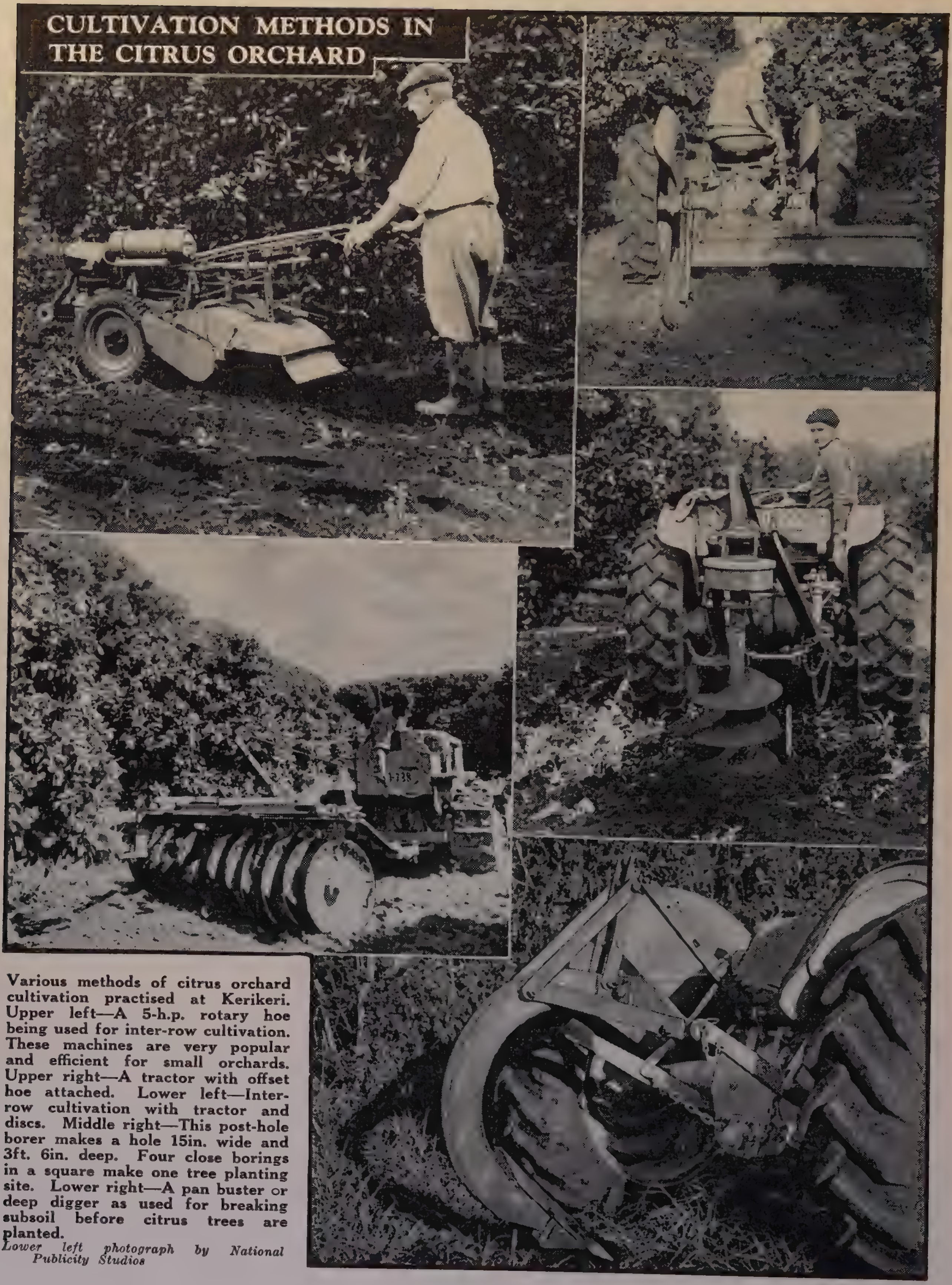
* * *

TREE PLANTING

THE large number of poor shelter belts throughout New Zealand indicates that many farmers should pay more careful attention to tree planting. One of the greatest mistakes is the failure to allow enough room for the type of shelter grown. Most shelter tree varieties require stockproof protection. Fences should be at least 9ft. away from the young trees and 12ft. should be regarded as the minimum for taller or more spreading varieties. If this space cannot be allowed, the shelter should not be planted, as an open, draughty shelter belt does more harm than good. Trees should be 6ft. to 9ft. apart in the row; the taller the shelter is the greater should be the distance between the trees. *Pinus radiata* should not be used for single-row shelters. If the soil is free draining and suitable, *Chamaecyparis lawsoniana* is preferable, and on wetter soils *Cupressus benthami* may be grown. *Cryptomeria japonica* is most suitable for tall, single-row shelters. If *Cupressus macrocarpa* or *Cupressus benthami* is to be used, the trees should receive a trim cut in the early years to encourage branching near the base. Often trees drown because they are planted in holes which collect water; therefore on wet clay soils care should be taken to drain surface water from the holes dug for the trees by cutting a surface slit in the ground leading from the lowest edge of the hole. In relatively frost-free climates trees are best planted in autumn on a well-prepared soil, but in colder climates early spring planting after severe frosts are over is preferable. Where drying winds are prevalent in spring planting should be done in autumn or late winter.

—*G. B. HADDOW*

CULTIVATION METHODS IN THE CITRUS ORCHARD



Various methods of citrus orchard cultivation practised at Kerikeri. Upper left—A 5-h.p. rotary hoe being used for inter-row cultivation. These machines are very popular and efficient for small orchards. Upper right—A tractor with offset hoe attached. Lower left—Inter-row cultivation with tractor and discs. Middle right—This post-hole borer makes a hole 15in. wide and 3ft. 6in. deep. Four close borings in a square make one tree planting site. Lower right—A pan buster or deep digger as used for breaking subsoil before citrus trees are planted.

Lower left photograph by National Publicity Studios

HEADING PHOTOGRAPH: These 27-year-old Best's Seedless orange trees are carrying a very heavy crop. The trees are budded on to *Poncirus trifoliata* stock and they receive annual dressings of 50lb. of fertiliser per tree.

Maintaining Soil Fertility in the Citrus Orchard

THE citrus areas at Gisborne, Tauranga, Te Puke, Auckland, and Kerikeri were not selected for citrus growing because of any similarity in soil type. The establishment of the commercial citrus industry in those districts can be attributed to the suitable climate of ample sunshine, well-distributed rainfall, and even temperatures. The soils of the districts vary considerably in structure and fertility and most are naturally low both in organic matter and fertility. In this article J. A. Cederman, Horticultural Instructor, Department of Agriculture, Kaikohe, discusses various ways of maintaining fertility in citrus orchard soils.

IT is necessary therefore that any increases in crop production be coupled with improvement of soil fertility, thus ensuring that the increase is steady and permanent and not a temporary one which deprives the soil of its accumulated fertility.

A citrus tree in full bearing makes a heavy and constant drain on the soil nutrients. To meet this demand the citrus grower must give careful attention to all cultural practices, and must take special care to supply the fertiliser requirements of the trees. Measures can be taken before trees are planted to ensure that they will have every possible advantage when they reach full bearing.

Soil Organic Matter

The decomposition of plant material and other organic matter in the soil results in the formation of the complex colloidal substance humus. The proportion of this dark organic residue present in the soil is frequently a reliable guide to the fertility of the land.

The ability of organic matter to increase the fertility of land can be attributed largely to its physical effects on soils. It provides a better soil structure and tilth, decreases water run-off losses, improves aeration, reduces erosion, and increases water-holding capacity.

Organic matter also serves as a storehouse of plant nutrients. In most soils nitrogen is held in an organic form. Decomposing organic matter favours the release of plant food elements from the soil minerals. Humus also helps in reducing the leaching of plant nutrients from soils.

Soils rich in organic matter are ideal for the growth of micro-organisms, which in turn are responsible for converting the plant food elements of the soil to forms in which they can be assimilated by plant roots.

To maintain and in many instances to increase the amount of organic matter of citrus orchard soils is an important factor in successful management. Continuous clean cultivation, while having certain advantages, hastens the loss of organic matter in the soil. There are several ways of adding organic matter to the soil, but each has attendant problems and the grower must assess the advantages and disadvantages of each and select the method which best suits him.

Cover Crops

The growing and turning under of suitable green crops is one of the most widely practised methods of adding organic matter to the soil. However,

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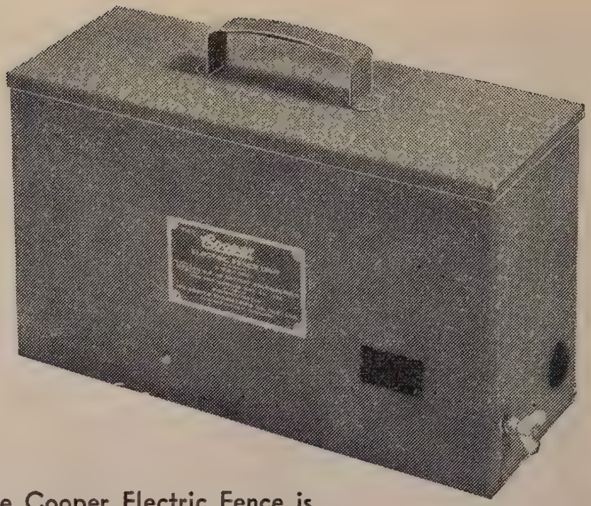

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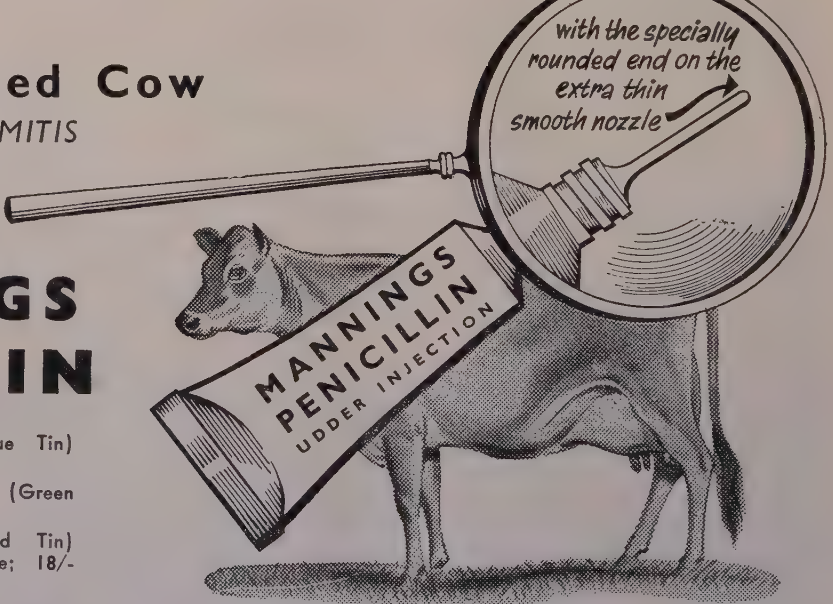
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MANNINGS

it is difficult to grow green crops successfully between large trees in a citrus orchard and green cropping is more generally confined to ground under preparation for planting and to ground between relatively small trees. Once the trees have reached mature size many growers rely solely on volunteer weed growth for green crops, which are worked into the soil two or three times each year.

The cover crop should be quick growing so that a maximum amount of plant material can be worked into the topsoil, preferably with a rotary machine or discs. The most popular crops are blue lupins, Algerian oats, a combination of the two, or mustard. Other crops that could be considered are Italian ryegrass and short-rotation ryegrass sown in the autumn and turned under in November.

When a mass of green material is turned into the soil a temporary shortage in the supply of nitrogen available to the trees may occur while the material is being broken down by the soil organisms. This may be overcome by the application of a quick-acting nitrogenous fertiliser just before the crop is turned in.

One advantage of the blue lupin is that it is a legume. Certain soil bacteria amass nitrogen in nodules on the roots of leguminous plants. This extra nitrogen is very helpful to the soil organisms which work on the decomposition of the cover crop and increases the quantity of nitrogen eventually available to the fruit trees. A disadvantage with blue lupins is that the seed can be the carrier of a serious fungous disease, *Sclerotinia sclerotiorum.* This disease has a very wide host range, which includes citrus and passion fruit.

Work among a tall wet cover crop is most unpleasant, especially during the harvest, but this disadvantage is considerably outweighed by the build-up in organic matter resulting in an increased availability of soil nutrients and improvement in water-holding capacity, soil structure, drainage, and aeration of soil.

All citrus growing districts may experience dry weather in mid-summer and it is then important that the trees should not have to compete with cover crops or weeds for the limited moisture. Unless the necessary additional moisture can be supplied by irrigation, the growing of green crops or permitting weed growth should be avoided during the usual dry weather.

Sod Culture

Sod culture as a means of increasing the organic matter in orchard soils has been practised for many years in England, but it is largely unknown in soil management in New Zealand.

Among the advantages of a well-maintained sward are pleasant conditions for spraying and harvesting and a steady build-up of the organic matter in the soil; the heavy cost of orchard cultivation is also eliminated. Many orchards have been planted on sloping ground and some type of permanent cover assists in preventing the loss of topsoil by erosion.

Disadvantages to be expected with sod culture are:—

1. A marked competition for plant nutrients during spring and autumn. It should be possible to overcome this by the application of extra manures.
2. That the competition for moisture in summer can be serious and may be a limiting factor unless there is adequate water for irrigation or orchards are in areas where the soil and rainfall are sufficient safeguards.
3. That the need for frequent mowing of the orchard pasture, particularly during dry months, offsets to some extent the saving made by eliminating cultivation.

New Zealand experience with sod culture has been variable, but mostly unfavourable. This, however, may have been due to the use of wrong techniques and it would be a mistake to condemn sod culture on present experience.

Sod culture has definite advantages, but the practice should not be adopted without caution and not unless adequate moisture—either natural or from irrigation—is available to meet the combined demand of trees and pasture. Additional fertiliser will also be required and the pasture must be mown regularly and kept very short during the dry months.

One experiment which was begun at Kerikeri in 1950 to compare sod culture with clean cultivation should yield valuable data in a few years.

Lucerne as a permanent cover crop has been tried in several districts. This crop grows quickly and may be cut several times a year and used for mulching around the trees. In the orchards observed, however, the lucerne stands are neither strong nor clean. It is possible that with careful preparation of the soil good stands could be established in young orchards, but it is unlikely that they could be maintained when the trees are mature.

Mulching

As a means of conserving moisture and increasing humus, mulching around citrus trees has been common in New Zealand orchards for many years. Practices vary, but the most common method is to build a layer of mulch from 6in. to 12in. deep from near the trunk out as far as the "drip circle" of a mature tree. Care must be taken, however, to keep the material clear of the trunk for, if placed too close, it may create conditions favourable for the development of serious bark diseases.

Mulching material may be cut and collected from pasture or green crops grown in the orchard, and generally this is the most economical method. Where costs are not too high it is of

Placing straw mulch around lemon trees. Mulching is an effective means of conserving moisture and increasing humus.

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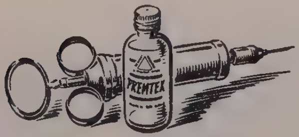

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advantage to bring material in from outside sources; waste stack bottoms or waste hay, straw, etc., are good mulching materials. In the Gisborne district several growers have been able to collect the pea and sweet corn refuse from a canning factory for mulching. Sawdust has been used with good results as a mulch around many garden plants and horticultural crops, but has not been used to any extent in orchards. There appears to be no reason why sawdust should not be satisfactory for mulching citrus trees and where sufficient sawdust is available a trial with this material may be worth while. However, extra nitrogen should be added to the soil before a sawdust mulch is applied to prevent any possibility of nitrogen starvation.

Fertilisers

The four major elements likely to be deficient in the soil are nitrogen, potassium, phosphorus, and calcium. Average analysis figures of manures supplying these elements are given below. The ingredients and the symbols employed are: N = nitrogen; $CaCO_3$ = calcium carbonate; K_2O = potash; P_2O_5 = phosphoric acid; MgO = magnesium oxide; * = inorganic manure; † = organic manure.

1. Nitrogenous Manures

*Sulphate of ammonia = 20.6 per cent. N
*Nitrate of soda = 15.5 per cent. N
*Nitrolime = 35 per cent. $CaCO_3$, 20.0 per cent. N
†Dried blood = 12.6 per cent. N

2. Phosphatic Manures

*Superphosphate = 20 to 21 per cent. P_2O_5
*Serpentine superphosphate = 4.8 per cent. MgO, 15 per cent. P_2O_5
*Basic slag = 15 to 20 per cent. P_2O_5
*Ground rock phosphates = 26 to 41 per cent. P_2O_5

3. Phosphatic-nitrogenous Manures

†Blood and bone = 6.6 per cent. N, 11.7 per cent. P_2O_5
†Bonedust = 3.5 per cent. N, 21.9 per cent. P_2O_5

4. Potash Manures

*Sulphate of potash = 48 per cent. K_2O
*Muriate of potash = 60 per cent. K_2O

Nitrogen

Nitrogen is vital for the growth of plants. It is a constituent of some of the important substances found in plant tissue and forms much of the dry matter of the living cells. Proteins which are of great importance in the seeds, and chlorophyll, the pigment responsible for the green plant colour, are nitrogen compounds. In spring, when trees are growing strongly, nitrogen is in great demand at the growing points and can be transferred rapidly from storage points in the plant. Adequate supplies promote larger leafage and they have an important influence on the setting of fruit.

Excessive applications of nitrogen can have detrimental effects on the quality of fruit, encourage excessive, vigorous growth, and make the tree more susceptible to disease.

Nitrogen deficiency is often associated with yellowish, sparse foliage and impaired shoot growth. Fruit setting and yield may also be seriously reduced.

A blue lupin cover crop in an orange block at Kerikeri.

Nitrogenous Manures

The nitrogen of the inorganic group is water soluble and quickly available to the plant. This is important to the fruit grower in winter and early spring, when normal supplies from within the soil are not freely available.

Sulphate of ammonia is now widely used by fruit growers as an ingredient of complete fertiliser mixtures and as a special purpose nitrogenous fertiliser. The continuous use of sulphate of ammonia tends to increase the acidity of most soils. This may be overcome by adequate liming.

Nitrate of soda is not used extensively by fruit growers. It could be used quite freely on light, open soils, but is not favoured for heavy, wet soils.

Nitrolime has recently been reintroduced by importers and is reported to have given very good results in experiments on citrus trees overseas. Its calcium content of 35 per cent. has a definite value.

The nitrogen carried by the organic group is insoluble in water and generally much more slowly available.

Blood and bone is widely used as an orchard fertiliser, both alone and in mixed manures.

The nitrogen in dried blood is fairly quickly available, especially during the warmer weather. This fertiliser is also suitable for use in autumn when quick growth responses are not desirable.

Bonedust has a very low nitrogen value, which is usually ignored.

Phosphorus

Soils in the citrus districts are naturally deficient in phosphorus and applications of phosphatic fertilisers are necessary. This element stimulates root activity, is closely concerned with all growth processes, and assists in seed and fruit formation. The presence of phosphorus aids the plant in taking up potassium and tends to some extent to counteract the effects of excess nitrogen.

A phosphorus deficiency is associated with a general lack of plant vigour and brownish green leaves, and may result in fruit of poor quality.

Phosphatic Manures

Superphosphate is widely used and well known. There has been a certain amount of opposition to its use by citrus growers in the past, but this is being overcome. Superphosphate is commonly used when cover crops are being sown and also in fertiliser mixtures.

Serpentine superphosphate is partly insoluble in water and is a little slower than superphosphate in becoming available. The magnesium content is important for soils with a

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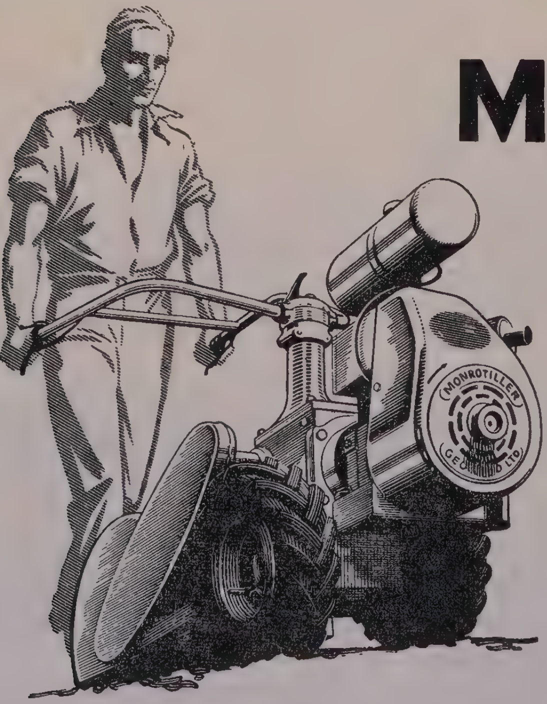

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deficiency of this essential element. A characteristic symptom of magnesium deficiency is a dull white to yellow coloration of the inter-veinal tissue. The deficiency, which is widespread in citrus orchards in New Zealand, usually occurs first at the base of the leaf and progresses toward the tip.

Basic slag, which has a slight lime value, is generally considered to compare favourably with superphosphate in high rainfall areas and on heavy, wet soil, especially where there is any tendency toward sourness.

Crushed rock phosphates in their raw state have a high phosphoric acid content. They are, however, insoluble in water and so are only slowly available.

Bonedust is not water soluble. The finely ground bone particles are fairly quickly available, but the larger pieces may stay in the ground for several years before they are absorbed. The same applies to the bone contained in blood and bone manure.

Potassium

Potassium is needed for the efficiency of the leaf and to assist in carbohydrate formation. The intake and retention of water by the plant tissue seem to be regulated by the quantity of potassium present and this element has a balancing effect on the intakes of nitrogen and phosphorus. Excessive potassium will unduly retard absorption of magnesium and calcium. Potassium is usually found to be in shortest supply in light, sandy soils.

Marginal browning of leaves, the characteristic symptom of potassium deficiency, has not been recorded on citrus trees in New Zealand.

Potash Manures

There is no evidence to suggest that sulphate of potash is in any way superior to muriate of potash for application to citrus orchard soils.

The apparently high cost per ton of potassium products is offset by the low application rate per tree and subsequent valuable results in tree health and fruit quality.

Calcium

It is common to refer to "fertilisers and lime", thus placing lime outside the group of recognised plant foods. However, calcium, which is the chief ingredient in lime, is an essential plant food. It stimulates root growth and assists in imparting vigour and hardiness to trees. It neutralises the acids formed in the plant, which would otherwise be toxic, and as calcium pectate it is used in the formation of the cell walls. Calcium helps to liberate the unavailable phosphate in the soil and it reduces soil acidity.

Many of the beneficial organisms are relatively inactive or absent in highly acid soils and this slows up the rate of decomposition and the conversion of manures to a form in which their elements become available to the plant roots. Earthworms also shun a highly acid soil and must have access to supplies of calcium to carry out their soil-building processes.

Lime in correct proportions regulates the availability of many important minor elements. Its physical effect as a soil conditioner is to group the fine soil particles together to give a larger crumb structure, which improves drainage and soil aeration.

The commercial citrus growing districts of New Zealand are all high rainfall areas. In their virgin state the soils have an initial lime requirement of from 1 to 2 tons per acre. In established orchards appreciable amounts of lime are taken up by the trees or leached from the soil through drainage.

The lime requirement of a soil is judged on its relative acidity as shown on a pH scale. By this scale, a pH of 7 is termed neutral, any reaction over pH 7 is alkaline, and under pH 7 is acid. Citrus, in common with many other plants, is considered to grow best in a soil ranging from about pH 5.7 to 6.5 The reason for recommending dressings of up to 2 tons per acre on new soils is because they are usually very acid and need heavy initial dressings to bring them within the optimum range of acidity. Soils in the Tauranga and Gisborne areas have a lower lime requirement than those of Auckland and Kerikeri. In Auckland and Kerikeri there is considerable evidence to suggest that the soil below 6in. is extremely acid and this may well be one of the reasons why the rooting zone of the trees is so restricted and an important reason for digging deep holes before planting and applying plenty of lime when refilling.

Farmyard Manures

Comparatively few citrus growers have easy access to supplies of farmyard manures. People who run poultry in conjunction with their orchards are able to apply worthwhile quantities of fowl manure to their trees at very little cost. Orchardists who are also dairy farmers or milk some cows as a sideline to fruit growing can distribute the manure in the orchard once or twice each year.

The position is more difficult for the average orchardist. Supplies of any type of farmyard manure are not easily obtained and even if they are available at reasonably low prices, transport costs tend to make them too expensive compared with other fertilisers.

The following table shows that farmyard manures contain only very small percentages of the principal nutrient elements required by plants.

AVERAGE COMPOSITION OF FRESH ANIMAL EXCRETA*

Type of animal	Percentage of nitrogen	Percentage of phosphate	Percentage of potash
Horse ..	0.55	0.30	0.40
Cow ..	0.40	0.20	0.10
Sheep ..	0.75	0.50	0.45
Pig ..	0.55	0.50	0.40
Poultry ..	1.00	0.80	0.40

* From "The Nature and Properties of Soils", by Lyon and Buckman, p. 433.

If annual dressings of from 10 to 20 tons per acre of farmyard manure can be applied each year, the soil organic matter content would be slowly built up and other manures, apart from lime, should not be required to any extent.

Orchard Practice

Preparing the Land for Planting

Land intended for orchard planting is usually either in pasture or is undeveloped country covered in scrub and gorse. Heavy modern cultivation equipment or hand clearing will quickly convert the scrub country to the stage when it can be planted in a cover crop. This development should, if possible, include deep ploughing or discing and the use of a special subsoiling machine or attachments to break up the compacted subsoil. Land in permanent pasture should be ploughed or disced to a depth of 6in., then allowed to fallow for some months. The next working should be a deep ploughing and the use of a subsoiler.

Ground carbonate of lime, sufficient to bring the pH within the range 5.7 to 6.5, should be distributed over the whole area well before the first crop is sown. The initial cover crop may be blue lupins, Algerian oats, or a mixture of both, sown at 1½ to 2 bushels of seed per acre. A dressing of 4cwt. of superphosphate per acre should be broadcast at the time of sowing and the seed and fertiliser covered by shallow cultivation.

If time permits two cover crops should be grown and worked in before the first planting of fruit trees is made. Where necessary drains should be laid before the trees are planted.

Planting

A little extra trouble taken at planting time to provide the best conditions for the young trees will be well repaid in later years.

Deep ploughing and the use of a subsoiler make it easier for tree roots to penetrate well into the subsoil. Holes up to 3ft. deep and 4ft. square may be dug by hand or with a tractor-operated post-hole borer. The holes are then filled with good topsoil; at the same time any well-rotted organic material that is available should be mixed in. Fairly heavy applications of lime and phosphate should also be spread through the soil when backfilling. This practice is considered of importance for the following reasons:—

1. The lime reduces the high natural acidity of the subsoil and encourages increased activity on the part of the soil organisms, better crumb structure, drainage, and aeration.
2. Supplies of calcium and phosphate placed well below the surface encourage deeper root penetration. The trees then obtain better anchorage, a wider feeding zone, and a greater resistance to drought damage.
3. This is the best opportunity the grower will have to place these essential elements well below the normal supply zone.

Maintenance of Soil Fertility

From pre-planting operations to the time when citrus trees have developed to a size when they can be expected to begin bearing worthwhile crops of fruit occupies from 5 to 7 years. During this period the grower should do everything possible to build up reserve levels of fertility in the soil.

While the trees are still young regular cover crops should be grown further to increase the humus in the soil.

Provided care is taken and extra fertiliser is used, catch crops of vegetables and other horticultural crops may be grown between the tree rows.

Citrus trees planted in autumn or winter should break into growth in spring as soon as the feeder roots become re-established. A dressing of ¼lb. of sulphate of ammonia or nitrate of soda per tree will help to encourage this early growth. All weed growth near the trees should be kept down by regular surface hoeing.

When the trees begin producing crops it becomes necessary gradually to increase the quantities of fertilisers applied to the soil.

Fertiliser Programme

Spring and early autumn are the two main growing periods for citrus trees. During summer and winter the trees build up food reserves for use in these periods. The trees must also meet a heavy demand for nutrients at blossoming time and from fruit setting until the crop is harvested. All fruit trees flower more freely and carry the best fruit on young wood, so it is important to ensure that the trees are well manured to encourage consistent cropping and steady growth.

The quantity of fertiliser required to keep a citrus tree healthy and growing strongly will vary with its age and size. It will also depend on the natural fertility of the soil and cultivation practices. A general recommendation is to apply 1lb. of a complete fertiliser for each year of the tree's age from planting, up to 25lb. to 30lb. per mature tree. Consideration should also be given to the percentage or strength of the nutrient elements in the fertiliser to be used. A typical example of this is dried blood with an analysis of 12.6 per cent. nitrogen compared with sulphate of ammonia with an analysis of 20.6 per cent. nitrogen. Thus it is necessary to use nearly twice the amount of dried blood to apply the same total units of nitrogen.

The following mixtures contain a proportion of the three main elements nitrogen, phosphorus, and potassium. They are balanced mixtures which may be used with confidence. Selection will depend on individual preferences and availability.

ORCHARD FERTILISER MIXTURES IN PERCENTAGES BY WEIGHT

No. 1

	Per cent.
Serpentine superphosphate ..	35
Sulphate of ammonia	10
Muriate of potash	10
Blood and bone	35
Dried blood	10

No. 2 Inorganic Mixture

Superphosphate	45
Sulphate of ammonia	45
Sulphate of potash	10

No. 3 Organic Mixture

Bonedust	15
Blood and bone	40
Dried blood	35
Muriate of potash (inorganic)	10

No. 4

Basic slag	25
Blood and bone	35
Nitrolime	30
Sulphate of potash	10

No. 1 mixture is a prepared proprietary manure widely used by orchardists and market gardeners. To obtain the correct nitrogen units for citrus it is necessary to add 2lb. of sulphate of ammonia to each 10lb. of the mixture. The selected mixture should be applied in two equal dressings of from 8lb. to 12lb. per mature tree in spring and early autumn. In all instances muriate of potash may be used to replace sulphate of potash or vice versa.

The fertiliser should be applied evenly around the trees to cover the zone of root activity. With mature trees the roots will meet between the rows and the fertiliser should be spread over the entire orchard area.

Conclusion

The importance of organic matter and the need for improving and maintaining soil fertility must not be overlooked. Nutritional requirements of citrus trees may be met in the different ways described, namely, the growing of cover crops, the application of mulch material, the use of farmyard manure, and finally the application of balanced fertiliser mixtures, or by a combination of these methods, if practicable.

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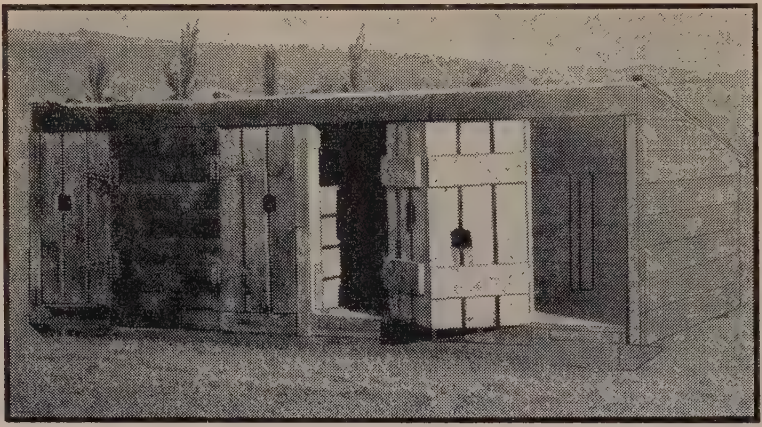
Lambing Pens Mounted on Skids



THE lambing period often causes worry to farmers in Southland, as stormy conditions may be expected at that time. Many casualties are prevented each year by the use of lambing pens or houses such as those illustrated above. These pens were designed by Mr. D. Graham, Black Hills, Waikaka, Southland, and have the advantages of being roomy, easy to shift from paddock to paddock, and cheap to construct.

The house is divided into four 6ft. x 3ft. pens by three partitions, of which the centre one only is fixed. The other two partitions are easily removed to form two compartments, each 6ft. x 6ft. The house is 12ft. 3in. long, 6ft. wide, 4ft. high at the front, and 2ft. 6in. high at the back. *Pinus radiata* is the only timber used, and it is treated with creosote after construction of the pens. Undressed 6in. x 1in. boards are used for walls, floors, doors, stays, and partitions, 4in. x 2in. studs form the framework, and the whole is mounted on skids of 6in. x 3in. timber. Old 7ft. sheets of corrugated iron are used for the roof, and give an overhang of about 9in. To prevent condensation tarred roofing material is laid under the iron. An air space of 2in. is allowed between the roof and top of the back wall, and draught is prevented by a 6in. x 1in. piece of timber attached vertically along the ends of the rafters. The doors are 20in. wide and have a hand hold made in them to allow closing and opening from the inside.

The design of the movable partitions is simple. The back edge is caught between two vertical battens, just discernible in the photograph, and the partition swung to against a vertical batten attached to the front wall. It is then held in by a bolt.

When the house is to be moved it is necessary to attach by wire a bar the same width as the distance between the outside edges of the skids. This is used as a drawbar to prevent the skids being strained out of parallel.

The small pens are invaluable for mothering and lambing ewes. There is sufficient room to prevent the ewe from lying on her lamb and for the farmer to handle the ewe inside if necessary. In stormy conditions two ewes with their lambs can shelter in each small compartment. For a stud or valuable ewe lambing on a rough night the large compartment is used. In it the ewe has room to lamb comfortably.

Clean straw is placed in the pens and renewed every 2 days, and the house is always placed facing the sun. No sick or infected sheep are ever allowed in the pens, and as an added precaution the pens are sprayed weekly with disinfectant.

For the handyman the construction of such pens should present no difficulty. In return many valuable ewes and lambs can be saved and the worry of lambing time reduced to a minimum.

—T. L. REID, Fields Instructor, Department of Agriculture, Gore

HEADING PHOTOGRAPH: It is easier to deal with rush problems in the early stages. The pasture shown is 16 months old and the rushes, which are 1ft. to 2ft. high, can be easily killed by spraying at this stage without mowing. If no control measures are taken, in another 12 months the rushes will be like those shown in the lower illustration on page 583.

Method of Applying Hormone Weedkillers

SOME of the points to be considered to ensure that the correct quantity of the appropriate material is applied when weeds are sprayed with weedkillers are discussed in this article by F. B. Thompson, Agricultural Chemist, Rukuhia Soil Research Station, Hamilton. The spraying of rushes and blackberry is described as examples, but the methods outlined apply to the control of other weeds.

WHEN the spraying of any weeds with hormone weedkillers is planned consideration should be given to the following four main points:—

1. The type of hormone to be used.
2. The quantity which should be applied.
3. How to apply the desired quantity.
4. The best time of the year and stage of growth to spray the weeds.

Each of these four points will be considered in turn as applied to the control of rushes and blackberry.

CONTROL OF RUSHES

Materials

The appropriate types of hormone to be used on various weeds are listed in an article by L. J. Matthews in the April 1952 issue of the "Journal". This article is reprinted in Department of Agriculture Bulletin No. 329, "Chemical Methods of Weed Control".

The materials recommended for the spraying of rushes are the esters of 2,4-D. In the references mentioned are listed the trade names under which the various hormone preparations are sold. The oil-based esters of 2,4-D suitable for rushes are sold as "Ataweed", "D.40", "Ethone", "Stantox P44", "Weedone 57 V.", "Weedone 57 N.V.", and "Yates 2,4-D".

In some early trials at Rukuhia and also in trials in other parts of New Zealand other materials, for example, the sodium salt of M.C.P., have given good results. Recently A. V. Allo, Instructor in Agriculture, Department of Agriculture, Tauranga, has had good results with the amine salt of 2,4-D. However, these formulations have not yet been tried on the full range of rush species, and it is known that some species are more resistant to hormones than others. The oil-based esters of 2,4-D have been used more extensively in experimental work and have consistently given good results; therefore it is recommended that they be used meanwhile, unless trials in the locality show that other materials are better. However, as soon as any other formulation can be confidently recommended for general use, the Department will give full publicity to the fact.

Rate of Application

Officers of the Department usually express the rate of application in terms of pounds of acid equivalent per acre. The recommended rate for use on rushes is 2lb. of acid equivalent per acre. The label on each tin of hormone weedkiller should state the concentration of active ingredients in pounds of acid equivalent per gallon. The brands of 2,4-D mentioned as suitable for use on rushes contain either 3.6lb. or 4lb. of acid equivalent per gallon. Therefore to apply the recommended 2lb. of acid equivalent per acre 4½ pints or 4 pints respectively of concentrate are required. For all practical purposes this can be regarded as ½ gallon of concentrate per acre.

Correct Method of Application

The first step is to decide how much of the spray mix is to be applied and then to make the correct dilution of the concentrate. Because of its nature

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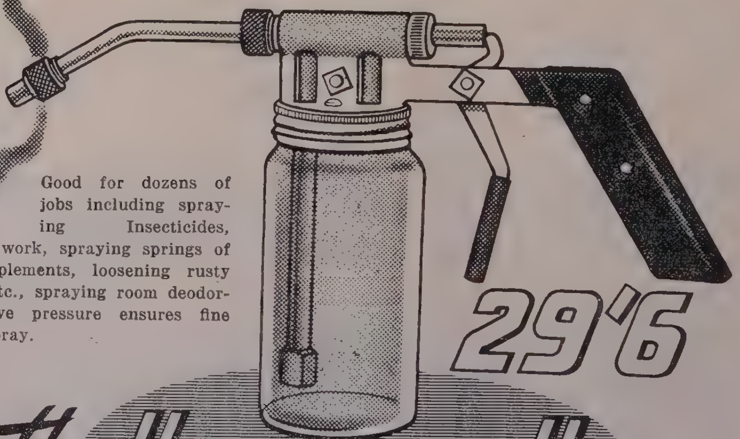

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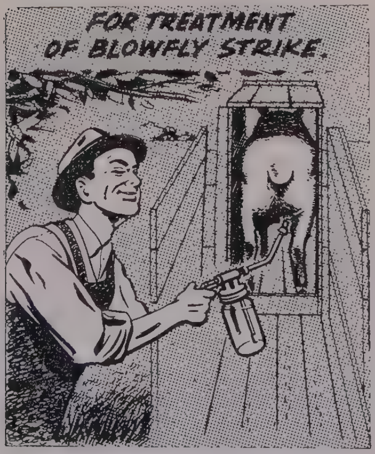
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the rush is more difficult to wet than, say, the buttercup, and therefore it is desirable to use an adequate volume of spray to ensure complete coverage of the rush stems. It is recommended that at least 20 gallons per acre be used and preferably more.

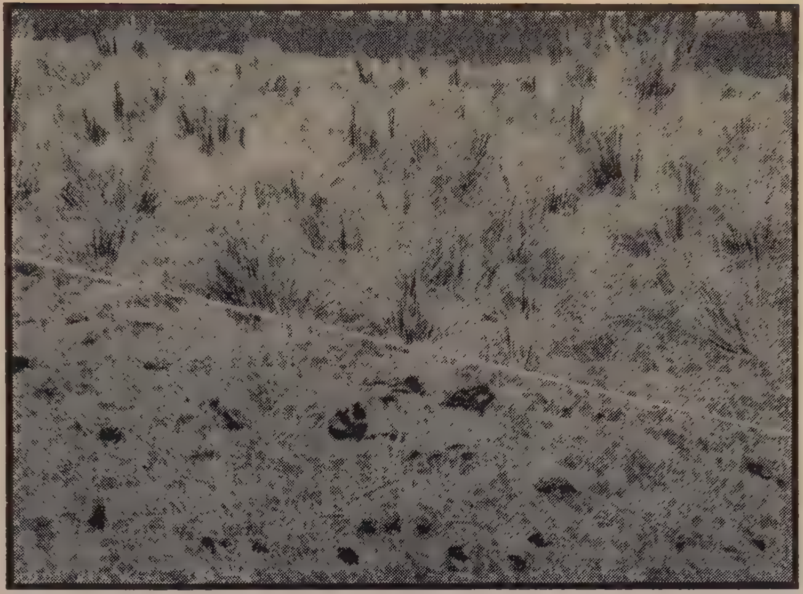
Boom spraying is the best way to apply the spray, provided the infestation of rushes is sufficiently thick to justify over-all spraying of the area and provided the area can be worked by a tractor. The amount of spray put on by a boom can be accurately calculated if the type of nozzle, pressure of the pump, and tractor speed are known. Each of these three points will be discussed.

Nozzles

Tips of three kinds, namely fan, hollow cone, and solid cone, are available for the type of nozzle normally used, and each kind is available in a number of different sizes. The tips are numbered according to the size of the orifice, and the number is stamped on the end near the orifice. Tips with the lower numbers have a smaller orifice and give a finer spray than tips with higher numbers; thus fan tip 28F gives a finer spray than 39F. When fine sprays are used there is increased risk of loss of spray by drift and damage to susceptible crops in the neighbourhood. Fan tips are usually used for boom spraying and No. 32F is probably the most common size. Hollow-cone tips should give a more even spray.

Pressure

The volume of spray delivered by a nozzle increases with increase in pressure, and tables giving the rated capacities can be obtained from the



Rushes may be controlled by spraying them with oil-based esters of 2,4-D. The area in the foreground in front of the line was sprayed in September 1952 with 2lb. of acid equivalent of ethyl ester of 2,4-D. There was no subsequent treatment before the photograph was taken in August 1953. The area had been hard grazed for some time to control the unsprayed rushes, which is the cause of the partly grazed rushes in the background and the bare ground in the foreground. The rush species is *Juncus effusus.*

Left—The soft rush with a solid pith (*Juncus effusus*) is grazed by stock in winter, provided the plants are not too big. Heavy stocking is necessary to graze down the larger plants. Right—Heavy stocking for some months has resulted in the grazing of the rushes in this paddock. Before the winter the rushes were like the larger clumps in the illustration at left and would be like that again by the next summer unless control measures were taken. Some farmers consider that stock are now too valuable to be subjected to the hard grazing necessary to get rushes down and that chemical methods of control are preferable. Some of the species other than *Juncus effusus* are not so readily grazed.

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Juncus polyanthemos, the hard rush with thin, wiry, shiny stems (right foreground), is not readily eaten by stock, but *Juncus effusus*, the soft rush with thick stems and solid pith (left foreground in front of hat), is often grazed in winter.

suppliers. The following table is an extract from these tables and gives the deliveries for the more common nozzles at the pressures normally used.

TABLE 1—GALLONS PER HOUR DELIVERED AT VARIOUS PRESSURES

Nozzle no.	Pounds pressure per sq. in.		
	30	40	60
Fan 28	4.2	5	6.3
Fan 32	6	6.5	7.6
Fan 39	10	11.3	14.2

Tractor Speed

If each nozzle on a boom is delivering spray at a uniform rate, the volume which falls on a unit area will depend on the speed at which the boom moves over the ground. The faster the speed is the less the volume per unit area will be. In the following table the volume applied per acre from a boom with nozzles spaced 14in. apart is stated for some of the nozzles, pressures, and speeds commonly used.

TABLE 2—GALLONS APPLIED PER ACRE WITH 14in. NOZZLE SPACING

Nozzle no.	Lb. pressure	Miles per hour		
		2	3	4
Fan 25 ..	30	13.5	9	6.7
	40	15	10.1	7.5
	60	19	12.6	9.5
Fan 28 ..	30	15	10	7.5
	40	17.8	11.9	8.9
	60	22.3	14.3	11.1
Fan 32 ..	30	21.4	14.3	10.7
	40	23.5	15.7	11.8
	60	27	18	13.5
Fan 35 ..	30	25.5	17	12.7
	40	28.2	18.8	14.1
	60	36	24	18
Fan 39 ..	30	36	24	18
	40	40	27	20
	60	50	34	25
Fan 46 ..	30	44	30	22
	40	49	33	25
	60	60	40	30

Spraying of Rushes

It will be seen from the table that volumes of more than 20 gallons per

Tall rush plants are not readily grazed by stock. These rushes are *Juncus effusus* and have grown since the pasture was sown 3 years previously. The larger rushes were not grazed the previous winter, and are now too big for grazing unless the stock are starved. They could be killed by mowing them and spraying the regrowth.

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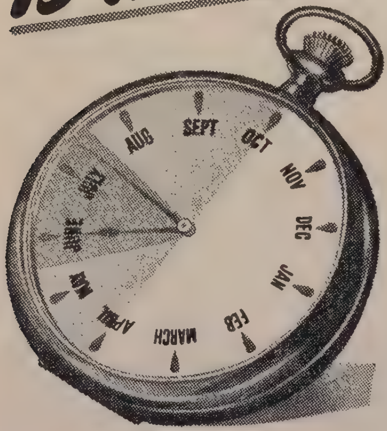

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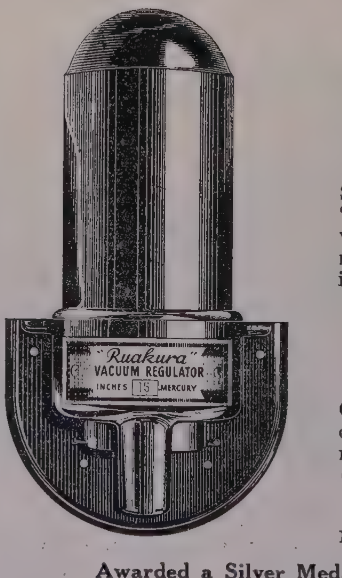

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acre are readily applied if the coarser nozzles are used. However, it is desirable to use a fine spray so that the narrow stems of the rush plants may be more easily wetted. Sufficient volume cannot be applied with the finer nozzles unless very slow speeds and high pressures are used. As a compromise it is suggested that No. 32 nozzles be used with a pressure of 30lb. to 40lb. per square inch and a tractor speed of 2 miles per hour. To apply the hormone weedkiller at the desired rate the concentrate should be diluted at the rate of ½ gallon in 22 gallons of water and sprayed with the nozzles, pressure, and speed stated. If the spray rig to be used is fitted with nozzles finer than No. 32, the operator may either spray once at a very slow speed or better still go over the area twice at about 2 miles per hour. The second spraying should be either at right angles or in the opposite direction to the first spraying.

It will be seen from the tables that tractor speed is important. If the actual speed is twice as fast as the calculated speed, only half the desired amount of hormone will be applied. A speed of 2 miles per hour is equal to 59 yards per minute or approximately 1 yard per second. The tractor should be timed over a measured distance or paced against a man walking at the desired speed. In the experimental work at Rukuhia it was found that 2 miles per hour was fast enough on the rough ground in the rush-infested paddocks.

Spot Spraying of Rushes

If a boom spray outfit is not available, or if the rush infestation is not thick enough for over-all treatment, the spray may be applied with a knapsack spray pump. The amount of concentrate to use in the mix depends, as with boom spraying, on the volume of mix to be applied. In contrast with the mathematical precision with which the volume applied by a boom can be calculated, it is difficult to know how much is put on by a knapsack. The volume will largely depend on how long the operator holds the nozzle over a plant, on the type of nozzle, and on the height at which it is held. The nozzle should preferably be of the low-volume, solid-cone type, and held no higher than necessary to give sufficient spread to wet the plants. If it is assumed that at least 50 gallons of spray are used per acre of rushes—not counting the ground between the rushes, which is not sprayed—the quantity of concentrate required is 1½ fl. oz. or 3 tablespoons per gallon of mix.

Time and Stage of Growth for Spraying

It is considered that the best period in which to spray rushes is from October to February, inclusive.

There are several different species of tall rush and these differ in their susceptibility to hormones. The species which can be killed most readily is *Juncus effusus*. This rush has soft, dark-green stems and is grazed by stock. Plants up to about 2ft. in height are killed by the recommended rate of application, but larger plants may survive. One of the most resistant species is *Juncus vaginatus*, the stems of which are bluish green and practically hollow. Plants of this species are not readily killed when they are about 2ft. high, but good kills have been obtained on young plants about 1ft. high.

To obtain the best results the rushes should be mown and the spray applied to the regrowth. The stubble should not be sprayed immediately after mowing, because some regrowth is required to absorb the hormone. There is insufficient experimental information to state the optimum height of regrowth at which each species should be sprayed, but as a general rule spraying before there is more than 1ft. of regrowth is recommended. Though *Juncus effusus* may be killed when there is more regrowth, this may not apply to all the other species. The plants should be at the desired height 4 to 8 weeks after mowing, according to the rate of growth. Therefore the plants should be mown in spring or early summer. If the rushes have been well grazed down by stock in winter, it is unnecessary to mow and the spray may be applied to the regrowth from the grazing. Good results have been obtained by spraying young plants up to about 18in. in height during their first year of growth. This avoids the necessity to mow before spraying.

CONTROL OF BLACKBERRY

Materials

Blackberry should be sprayed with esters of 2,4,5-T and not with derivatives of 2,4-D. The former are sold under the following trade names: "Butoxone", "Relionus 2,4,5-T", "Stantox T.45S", "Summit 2,4,5-T". "Wee-

This tall rush, *Juncus pallidus*, has thickly infested the 2-year-old pasture on wet peat. This is the largest variety of the common rushes and has thick, hard stems with solid pith. It can be controlled by spraying with esters of 2,4-D if the plants are first mown and the regrowths sprayed.

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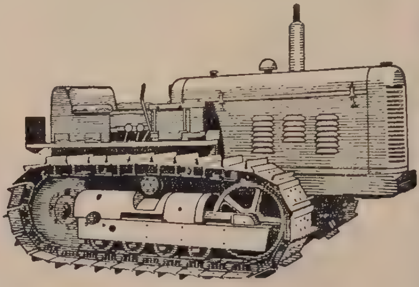

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Rate of Application

The recommended rate is 3lb. to 4lb. of acid equivalent per acre. Since all the 2,4,5-T compounds mentioned contain 3.6lb. of acid equivalent per gallon, 1 gallon of concentrate should be applied per acre of blackberry.

Correct Method of Application

Some users are puzzled regarding the best dilution rate to use. They have found that 1 : 300 is apparently as good as the recommended dilutions, which vary from 1 : 60 to 1 : 200. Dilution rate cannot be considered apart, but must always be considered in conjunction with the volume of spray mix applied. From the two figures the amount of concentrate applied can be calculated, as is shown in the following table.

TABLE 3—CONCENTRATE PER ACRE

Dilution rate	Gallons per acre Spray mix	Gallons per acre Concentrate
1 : 100	100	1
	200	2
	300	3
1 : 200	100	½
	200	1
	300	1½
1 : 300	100	⅓
	200	⅔
	300	1

The table also shows how the appropriate dilution rate can be calculated for any given volume of spray mix so that a specified amount of hormone concentrate can be applied. Thus to apply the desired 1 gallon of 2,4,5-T per acre on blackberry a dilution rate of 1 : 100 should be used when 100 gallons of spray mix are applied, a dilution rate of 1 : 300 if 300 gallons of mix are applied, and so on. The actual volume of mix used could easily vary from 100 to 300 gallons per acre of blackberry, according to the density and height of the infestation and the type of equipment used. Thus, within the limited range of the figures quoted in Table 3, use of the wrong dilution could easily result in either three times or one-third the desired quantity of concentrate being used. Therefore it is suggested that the operator should ascertain the volume being applied by measuring the actual volume used in a trial run on a measured area of blackberry; then the dilution required could be determined from the calculated volume of mix per acre. The quantities of concentrate required in 40 gallons of mix to give various dilution rates are given in the following table.

TABLE 4—CONCENTRATE REQUIRED FOR 40 GALLONS OF MIX

Dilution rate	Pints (approx.)	Fluid ounces
1 : 100	3	64
1 : 150	2	43
1 : 200	1½	32
1 : 250	1¼	26
1 : 300	1	21

It may be wondered why it is necessary to determine the volume used and to calculate the appropriate dilution rate for the spraying of blackberry, whereas for spot spraying of rushes a guess was sufficient. The 2,4,5-T concentrate used for blackberry and gorse costs about 50 per cent. more per gallon than the 2,4-D used for rushes, and, further, twice the quantity is required, that is, 1 gallon of concentrate is required per acre of blackberry, but only ½ gallon per acre of rushes. Therefore, as the cost per acre of the hormone for spraying blackberry is three times as much as that for rushes, it may be worth taking more care to make sure that the right amount is applied.

Time and Stage of Growth for Spraying

The best time of application and the best stage of growth for the spraying of blackberry are fully described in an article in the May 1952 issue of the "Journal" which is also reprinted in Bulletin No. 329, "Chemical Methods of Weed Control".

The best periods for spraying are summer and early autumn. Plants should be in full leaf and second-year canes should be fruiting or past fruiting. Regrowths should be allowed to grow for 1 year and should then be treated in summer or early autumn after the leaves are fully grown.

Gorse Control

In this description of the methods used to make sure that the correct quantities of weedkillers are applied rushes and blackberry have been used as examples. However, the methods described have a more general application. For instance the methods described for the spraying of blackberry may be used for spraying gorse more than 3ft. high. Similar methods may be used for smaller gorse plants, but the quantity of concentrate could be reduced to about ½ gallon per acre.

If the methods described are followed, users of the materials should avoid disappointing results through inadequate application on the one hand and the waste involved in excessively high rates of application on the other.

Pruning Young Peach Trees

By R. VINEY, Horticultural Instructor, Department of Agriculture, Gisborne

THE first few years' prunings are the most important in the life of any fruit tree. This applies particularly to young peach trees planted for early production to offset establishment and working costs in a new orchard of mixed fruit until the other trees start bearing. The main objective when planting peach trees should be to have the trees bearing maximum crops of fruit as soon as possible, provided that their subsequent life and production are not adversely affected.

IN some districts it is common to prune peach trees hard back every winter to promote growth. Though this method is suitable for older trees, hard pruning for the first 5 or 6 years may have a detrimental effect on a tree by retarding its height, inducing over-crowding of limbs and lateral growths, and delaying maximum production.

During the first few years after planting pruning should be done with the object of developing a balanced, well-shaped tree with a maximum of fruit-bearing wood. The ideal is a tree with five or six well-spaced leaders inclined outward at an angle of approximately 30 degrees from the vertical. Each leader should have three or four strong, well-spaced, permanent fruiting arms, on which there should be an abundance of lateral growths from which a selection of suitable fruiting wood may be made at pruning time.

After being planted the young peach tree should be pruned well back to promote strong growth for the framework. Note the three well-balanced growths.

Main Parts of the Tree

Before pruning of peach trees is begun it is essential that the main parts of the tree are easily recognised as follows: (a) Leaders, (b) fruiting arms, (c) laterals, and (d) leader shoots (the current season's extensions of the leaders).

The leaders form the framework of the tree and carry the fruiting arms, on which most of the laterals are carried. These laterals are furnished with fruit buds and leaf buds, some having a predominance of the former and others of the latter.

Pruning at Various Stages

The following are recommendations for pruning at various stages:—

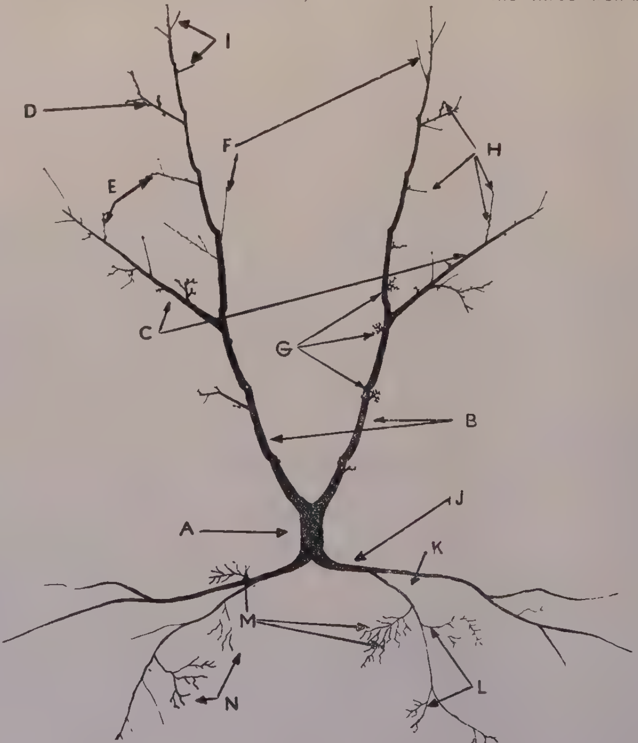
First Year (Planting Time)

After the trees are planted three or four strong, well-placed growths should be selected and these should be pruned hard, leaving only three or four basal buds on each growth. The top buds should be in the correct position for subsequent growth to form the framework required. All other growths should be removed.

Trees which are unsatisfactory in shape may be pruned to single buds at the bases of side growths or even to rods.

Second Year

Provided that growing conditions have been favourable during the first year after planting, there should be a number of good, strong, upright growths. Five or six of the strongest and best spaced of these should be selected to form the leaders of the tree at the second winter pruning and all other growths removed, particularly any very straight ones inside the tree.



Definition of tree parts. A—Trunk. B—Leaders. C—Fruiting arms. D—Lateral. E—Fruit twigs. F—Wood shoots. G—Fruit spurs. H—Fruit buds. I—Leaf buds. J—Main root. K—Secondary root. L—Lateral roots. M—Fibrous roots. N—Hair roots.

The growths selected as leaders if not too upright may be left untipped so that the main growth will come from the leader shoots during the following growing season.

It is important that any lateral growths which are about the same height as the leaders should be removed during pruning. If this is not done, there is always the possibility that the main flow of sap will be to one of these laterals and that an intended leader will be weakened.

If any leader is too erect, it may be cut back to an outside lateral, which will then continue as the leader. This lateral should be left uncut so that the leader shoot will make the main growth.

Excess lateral growths should be removed to avoid over-crowding. As far as is possible the leader shoots should be kept to approximately the same height.

As peach trees fruit on laterals which have formed the previous season, the objective in pruning is to obtain an abundant supply of new wood.

Third Year

The third year's pruning is one of the most important, as at this stage is begun the selection of strong laterals to act as fruiting arms. In future years these arms will carry the bulk of the crop.

Two or three strong laterals which are a suitable height from the ground should be selected and all other strong laterals removed. The selected laterals should be on the outsides of the leaders and sufficiently high that they will not impede cultivation later.

Vertical growths appearing subsequently on these fruiting arms should be removed during prunings. This assists in keeping the fruiting arms more horizontal, induces better fruiting, and admits light and air to the inside of the tree.

The leaders should again be treated in the same way as was done the previous year, though it may be necessary to prune most of the leaders to outside laterals to prevent them from becoming too erect. Any laterals which may compete with the top of the leader should be removed.

Lateral growth should be thinned out where necessary to prevent overcrowding.

Fourth to Sixth Year

By the fifth year (or earlier) peach trees should be producing a crop. As the framework of the tree will now be fairly well established, the principal objective should be to develop the fruiting arms and encourage the annual growth of fruiting wood. Fruiting arms should be pruned to promote more or less horizontal growth, and any vertical growths should be removed.

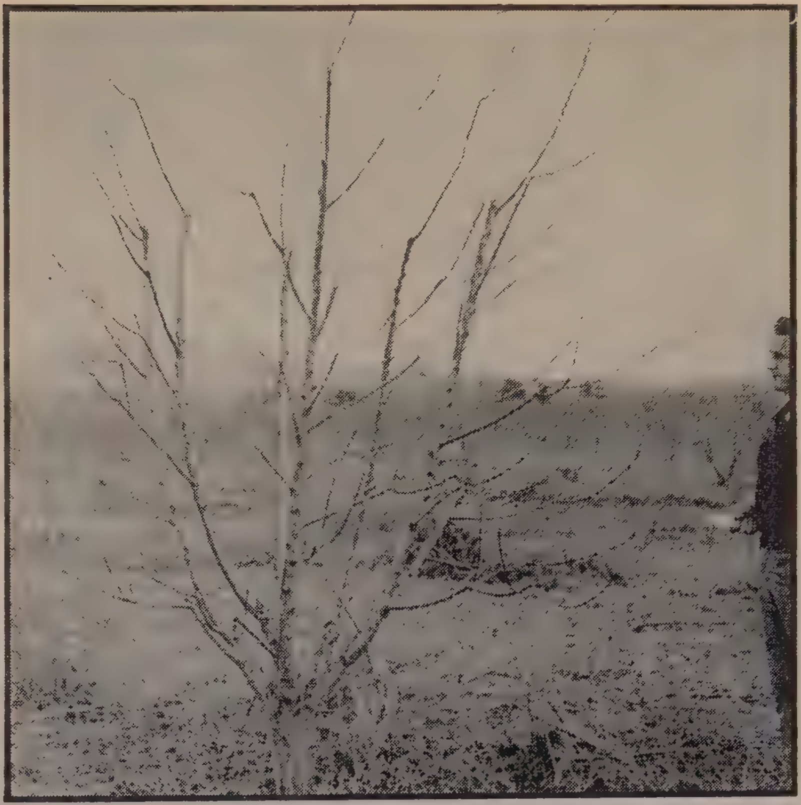
As peaches fruit only on 1-year twigs and laterals, all laterals left for fruiting during the previous season should be removed to make way for new fruiting wood. Further strong laterals may now be selected at suitable spacings on the extensions of the leaders to increase the number of fruiting arms. It is desirable that these should be as nearly horizontal as possible.

Future Pruning

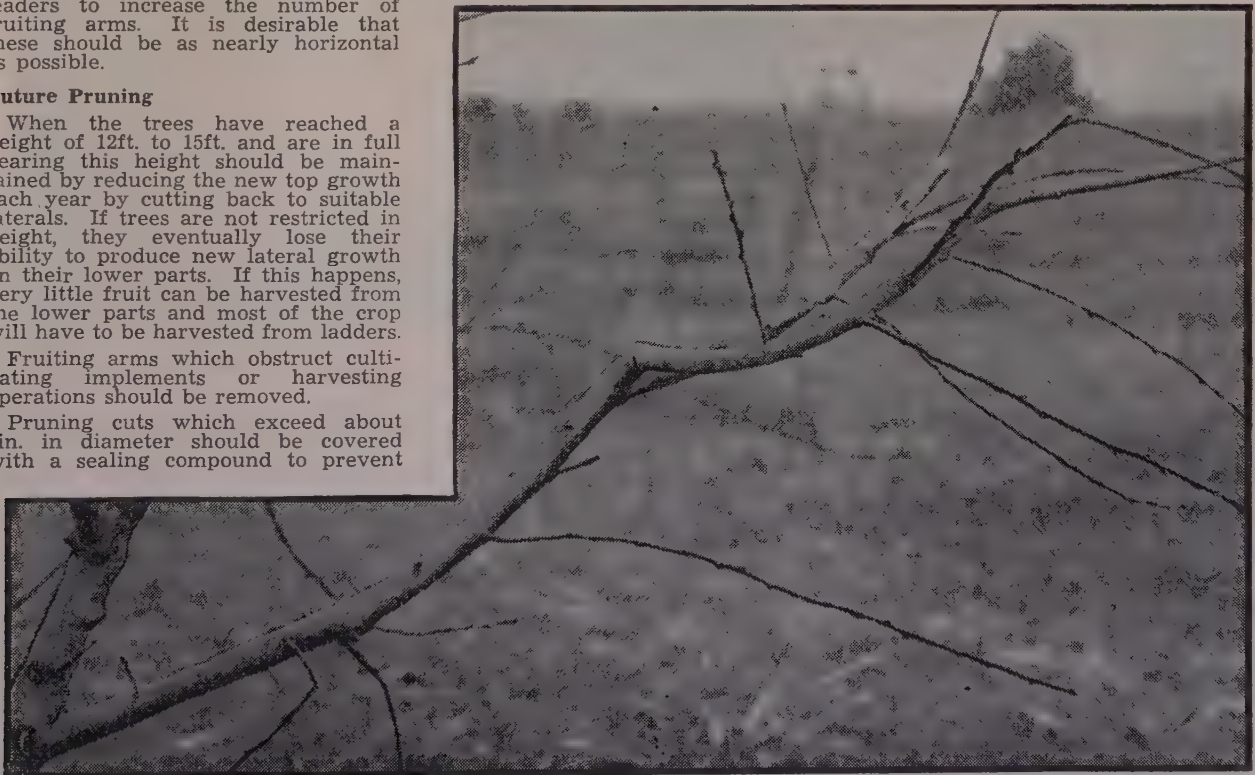
When the trees have reached a height of 12ft. to 15ft. and are in full bearing this height should be maintained by reducing the new top growth each year by cutting back to suitable laterals. If trees are not restricted in height, they eventually lose their ability to produce new lateral growth on their lower parts. If this happens, very little fruit can be harvested from the lower parts and most of the crop will have to be harvested from ladders.

Fruiting arms which obstruct cultivating implements or harvesting operations should be removed.

Pruning cuts which exceed about 1in. in diameter should be covered with a sealing compound to prevent



Above—A well-shaped peach tree 4 years after planting. The leaders have been headed out at the winter pruning to spread them. Below—Good type of fruiting arm.



the entrance of wood-rotting fungi and spores of silver leaf disease.

Throughout the life of trees the removal of laterals which cause overcrowding should be continued and the fruiting arms should be maintained horizontally; any laterals which show signs of brown rot infection should be removed.

Main Points

The main points in the pruning of peach trees are:—

1. The main purpose of leaders is to provide a sturdy framework on which to carry fruiting arms.
2. Leaders should incline outward at about 30 degrees from the vertical and five or six are sufficient for most trees. Generally, the more leaders there are the weaker they will be. Bare parts of trees should be filled in with fruiting arms and laterals.
3. The main purpose of fruiting arms is to carry fruiting wood; they should be kept as near horizontal as is possible.
4. All vertical laterals should be removed from fruiting arms.
5. Weak fruiting arms should be removed if they can be replaced by strong ones.
6. If any fruiting arm is not required, it should be removed, not shortened back to a stub.
7. Trees should be kept open in the centre to admit light and air.
8. Trees should be kept to a height which will satisfactorily maintain growth on the lower parts of the trees.
9. Overcrowding of growths should be avoided.
10. Cropping depends on bearing surface; therefore a good supply of young wood should be maintained and "spent" and diseased wood should be removed.
11. Peaches are borne on growth of the previous season and set best on horizontal laterals.
12. Laterals which may compete with leader shoots should be removed.
13. Large pruning cuts should be covered with a sealing compound.

All photographs by R. W. Orr.

Bulletins for Orchardists

Nos.

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101 Cause and Control of Brown-rot in Fruit.
104 Silver Leaf in Orchards.
112 Powdery Mildew in the Orchard.
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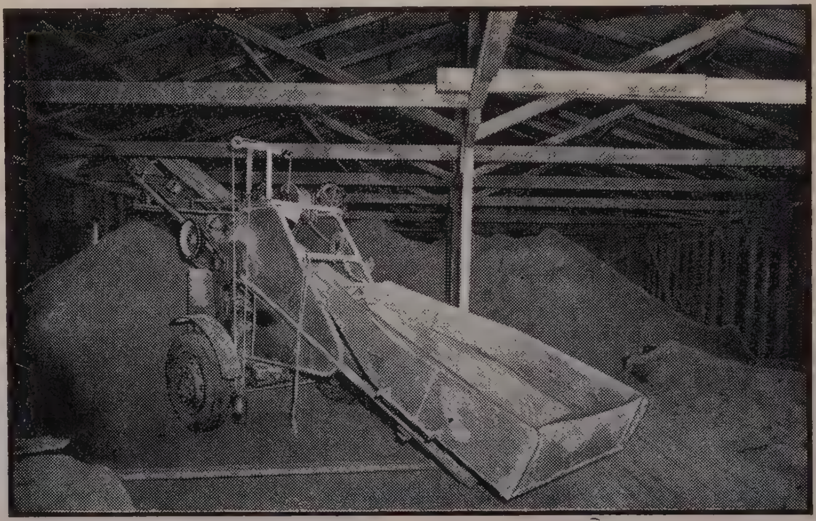
Bulk Handling of Superphosphate Used for Aerial Topdressing

By A. A. DUNCAN, Instructor in Agriculture, Department of Agriculture, Wanganui

BULK handling of superphosphate from the fertiliser works to the hopper of the aeroplane has been introduced in Wanganui and Taranaki this season and is a further progressive step in the development of aerial topdressing. The chief advantage in the change-over from bags is that there is no call on the farmer's labour supply to help load the aeroplane; this is done by the topdressing company with a mechanical loader. Where the phosphate is taken to the airstrip in bags it takes up to 5 men to keep the bagged phosphate up to the larger type of aircraft used for aerial topdressing. The provision of a team of workers at the airstrip is a considerable inconvenience to the farmer in organising his labour force and to the farmer's wife in the provision of meals, because owing to the vagaries of the weather, it is never certain how long the aeroplanes can operate.

THE cost of aerial topdressing with bulk superphosphate compares very favourably with that of bagged superphosphate, largely because bulk superphosphate ex works is 21s. 6d. a ton cheaper. There is also a tendency for bulk fertiliser to be carried cheaper than bagged, because loading particularly and unloading are quicker and do not involve heavy lifting.

The unloading machine illustrated is owned by a carrying company and is transported from shed to shed; it builds a cone up to 9ft. high, and this means that the building has to have a 10ft. stud to give full clearance to the machine. Some sheds that have been built for storing bagged manure need alteration before being satisfactory for bulk storage. In the shed illustrated arched steel trusses will be installed, which will give a full clearance to the loader and do away with centre studs. In any alteration to an existing building the aim should be to allow as clear a floor space as possible, to facilitate the movement of the unloading machine. With sheds for bulk storage it is also necessary to strengthen the outside walls and to rebuild or strengthen the floor to take the dead load of approximately 5cwt. per square foot.



Editor: P. MACKINTOSH.
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Development of South Canterbury Browntop Country

By J. L. SYMONS, Fields Instructor,
Department of Agriculture, Waimate

THROUGH the use of good agricultural practices large areas of unproductive browntop country in South Canterbury have been developed to the stage where they will now maintain high-producing pastures. There is still, however, a fairly large area which either has not been fully improved or which has, through incorrect management, reverted to browntop. By adoption of methods practised by successful farmers in the initial development of this class of country and application of correct grazing management these areas could also be brought into full production.

Digger ploughing breaks the furrows and exposes the maximum of soil to the weather.

THREE main methods may be employed in the initial breaking in of browntop country. First, the turf can be ploughed under with the short or long mould-board plough; secondly, the turf can be top worked by grubbing or skim ploughing before ploughing; or thirdly, it can be ploughed under with a digger plough with skimmers attached. All these methods have their adherents, but the digger plough, with its ability to turn the turf well under and to expose the maximum amount of soil to the action of winter frosts, has much to recommend it.

Irrespective of the method employed, two main essentials must be kept in mind. First, the ground must be ploughed as early as possible, preferably before the shortest day, to gain the maximum benefits from exposure to the weather. Secondly, the ploughing must not be too deep, as with deep ploughing too much clay tends to be brought to the surface. Generally, ploughing between 5in. and 7in. will be sufficient to turn the turf well under.

Spring cultivation should be started in August or September when the ground is fit to work. A light cut with the discs at this stage will be sufficient to consolidate the furrows and check any grass growth between them. Later, depending on seasonal conditions, cultivation should be confined to two or more strokes with a stiff-tined cultivator, preferably the grub harrow. Following this with one or two strokes of the tine harrows should be sufficient to provide the good, rubbly tilth so desirable on this type of country. Where a ridged crop is to be sown a cut with the discs just before ridging is advisable to avoid the ridges being composed of the dry, rubbly soil. Conversely, care is needed to prevent the soil becoming too fine, as it will then cake badly with the first heavy rain or lead to a heavy crop of spurrey or yarr.

Initial Crops

Crops which can be successfully grown on the first furrow on this land are confined mainly to linseed or a forage crop. Linseed has proved of value with its ability to yield comparatively well under low fertility conditions and to leave the soil in good condition for a succeeding forage crop. Its only drawback is that in wet autumns harvesting is liable to prove a problem.

Winter feed crops of swedes, chou moellier, or turnips are today widely grown as a first crop. This practice has much to recommend it, and it gives a good lift to soil fertility, which aids considerably in the subsequent establishment of grass. High-yielding crops can usually be obtained if ample time has been allowed for the preparation of the ground and a good seed-bed is obtained. Wherever possible forage crops should be sown on ridges. This permits intercultivation in the early stages of growth to keep yarr and other weeds in check and lessens the wastage when the crop is fed off while the soil is wet.

Topdressing

Heavy dressings of lime are the prime essential for browntop country, for without it a vigorous establishment of clovers cannot be obtained. Experimental trials in conjunction with soil tests have indicated that an initial dressing of 2 tons of carbonate of lime per acre is required. Better soil structure is obtained if 1 ton of lime is applied to the worked ground before the initial crop, followed by 1 ton before sowing to grass, rather than by delaying all applications until after the initial crop. To ensure a vigorous establishment of clovers the lime should be worked lightly into the surface soil before grassing down is done. Too many pasture failures have resulted where, because of varying reasons, lime has not been applied until the spring or summer after the pasture sowing.

Phosphates are essential for the growing of forage crops on browntop country and many poor crops can be attributed to too light an application at sowing. For ridged crops best results have been obtained with up to 4cwt. per acre of reverted superphosphate; with drilling, 2cwt. per acre is necessary. With linseed crops at least 2cwt. of superphosphate should be sown. When sowing to pasture is being done the application of 2cwt. to 3cwt. of superphosphate ensures that the grass and clover receive a good start and quickly helps to raise the fertility to the stage where a high-producing pasture can be maintained.

Avoiding Crop Losses during Consignment

FLOUR millers often receive consignments of wheat in dirty railway trucks which have previously been used for bulk lime or coal deliveries and have not been cleaned out. If the wheat has been insufficiently covered with tarpaulins during a wet period while under consignment, the bottoms of the trucks become wet and wheat in the sacks in contact with them might be ruined. This can be avoided by using only clean trucks and by covering them with two tarpaulins. These precautions should also be taken with consignments of milling oats and malting barley and with grass and clover seed forwarded for machine dressing.

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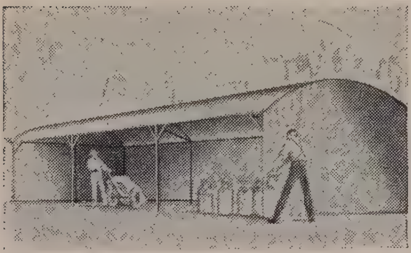

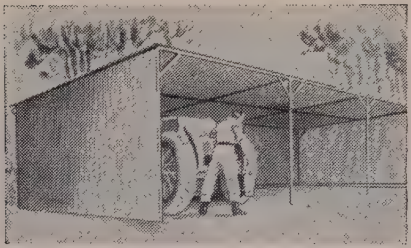

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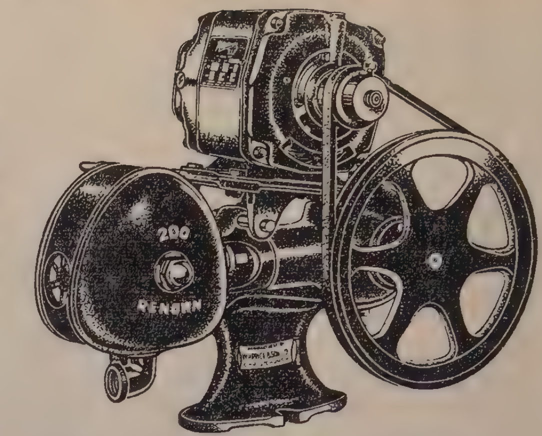

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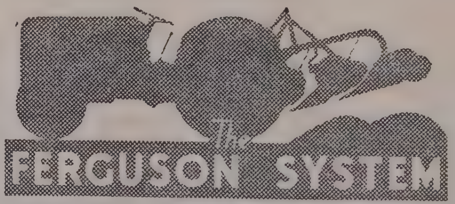

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Good Rearing of Dairy Stock

By C. P. McMEEKAN, Superintendent, Department of Agriculture Animal Research Station, Ruakura

THE two previous articles in this series, published in the April and May issues of the "Journal", dealt with the rearing of dairy stock from birth to weaning and from weaning to mating. This article describes the rearing of calves from mating to calving and concludes the series with a section about diseases which have not already been discussed in the earlier articles.

THE third main stage in the life of the dairy heifer, from mating to calving, is not subject to the worries and difficulties typical of the first two phases. It is nonetheless important, because, as has already been pointed out, the size and condition of the dairy heifer at first calving can affect the level of production of the heifer for at least the first 2 years of her productive life.

The Target

As in the other two stages, studies of the growth-rate of heifers over this period have now been sufficiently numerous to enable growth targets to be set. These are shown in the table at right and, as in the second stage, are presented on a monthly basis. The liveweights shown represent the mean mid-month weights of a typical group of high-grade Jersey heifers from 15 months onward until calving at 2 years of age. Again the corresponding chest girth measurements are given so that farmers may check up the performance of their stock, even though regular weighings are impracticable. It will be noted that the target calls for a liveweight of approximately 500lb. at mating, 665lb. at the beginning of the second winter, and 735lb. at calving.

GROWTH OF JERSEY 2-YEAR-OLDS FROM MATING TO CALVING

Time month		Liveweight lb.	Chest girth in.
October (mating)	..	505	55
November ..	..	547	56½
December ..	..	595	58
January ..	..	630	59½
February ..	..	650	60
March ..	..	665	60½
April	..	675	61
May	..	687	61½
June	..	710	62
July (calving)	..	735	63

Fig. 1 translates the weights into a growth curve with the heavy middle line corresponding to the "good" growth asked for. The shaded portions above and below represent better and worse performances.

The "good" curve is probably better than that commonly found in the industry today. It is easy to attain, however, and should be aimed at by every farmer seeking to give his young stock a good opportunity of producing up to the limit of their inherited capacity from the time they first calve.

Grazing Management

As in the second period, good feeding of the dairy heifer at this time is practically entirely dependent on good grazing management. Since the needs of the animals at this age are not so critical and since mistakes made at any one time are more easily corrected later than during either of the first two stages, a less generous grazing policy can be used.

Thus at Ruakura in the long-term experiments described previously the method of management during the second year is to run the animals as dry stock followers to the milking herd. This method uses the principle of rotational grazing management and thus carries with it the many advantages of this method. By acting as followers the cattle—now at the stage where their daily appetite is at a fairly high level—are not competing with the milk-producing cows. In contrast, they are doing a good job in cleaning up the field preparatory to its closing, spelling, and subsequent regrazing by the calves and milkers. On a daily shift rotational basis of the main herd on a well-managed farm carrying good-quality pastures food of sufficiently high quality is available to permit a growth-rate equivalent to the targets set.

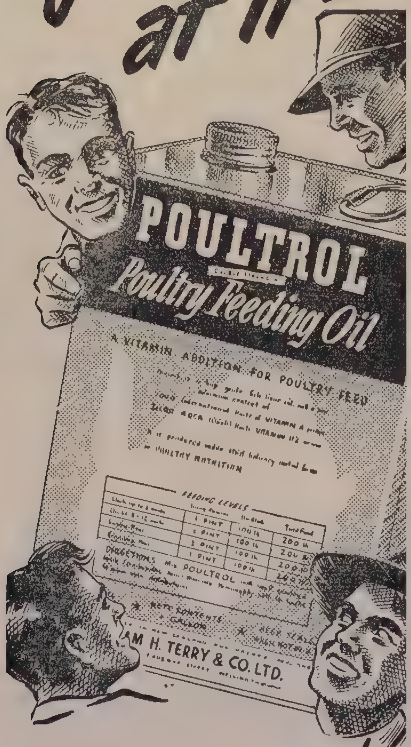
Rearing from Mating to Calving

1. The growth target in this final stage is a heifer calving at 2 years at a liveweight of 700lb. to 750lb.

2. Grazing management after mating must be on a rotational plan, with the young stock acting as followers to the milking herd.

3. Supplementary feeding with hay and silage, especially in winter, is essential to calving down in high condition.

Any way you look at it—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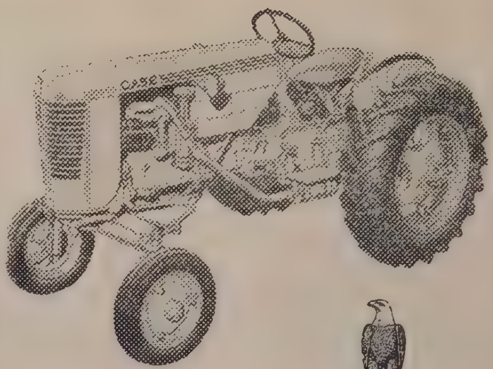

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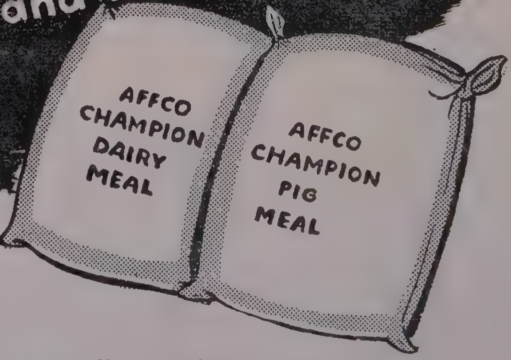
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Supplementary Feeding

Hay and silage must be provided in sufficient quantities, both during the summer dry spell, when pasture is inadequate, and in winter, when green feed undoubtedly will not be available in sufficient supply. The hay and silage need not be of such high quality as that required during the post-weaning to mating stage. The animals are older and can handle a more fibrous diet with greater efficiency, but mouldy, very poor quality hay must be avoided.

A daily ration of up to 5lb. of hay per animal and up to 10lb. of silage will be needed during summer, depending on grass growth. A ration of 5lb. of hay and 10 to 20lb. of silage in winter will be needed.

Sufficient provision for this purpose must be made in planning the fodder conservation policy of the farm. This is often neglected and supplementary feed requirements are based only on the needs of the milking herd. Over the years well-reared 2-year-old cattle at Ruakura have consumed an average of 5cwt. of hay and 1 ton of silage during their second year. These quantities can be taken as general guides if a growth performance equivalent to the "good" curve of Fig. 1 is desired.

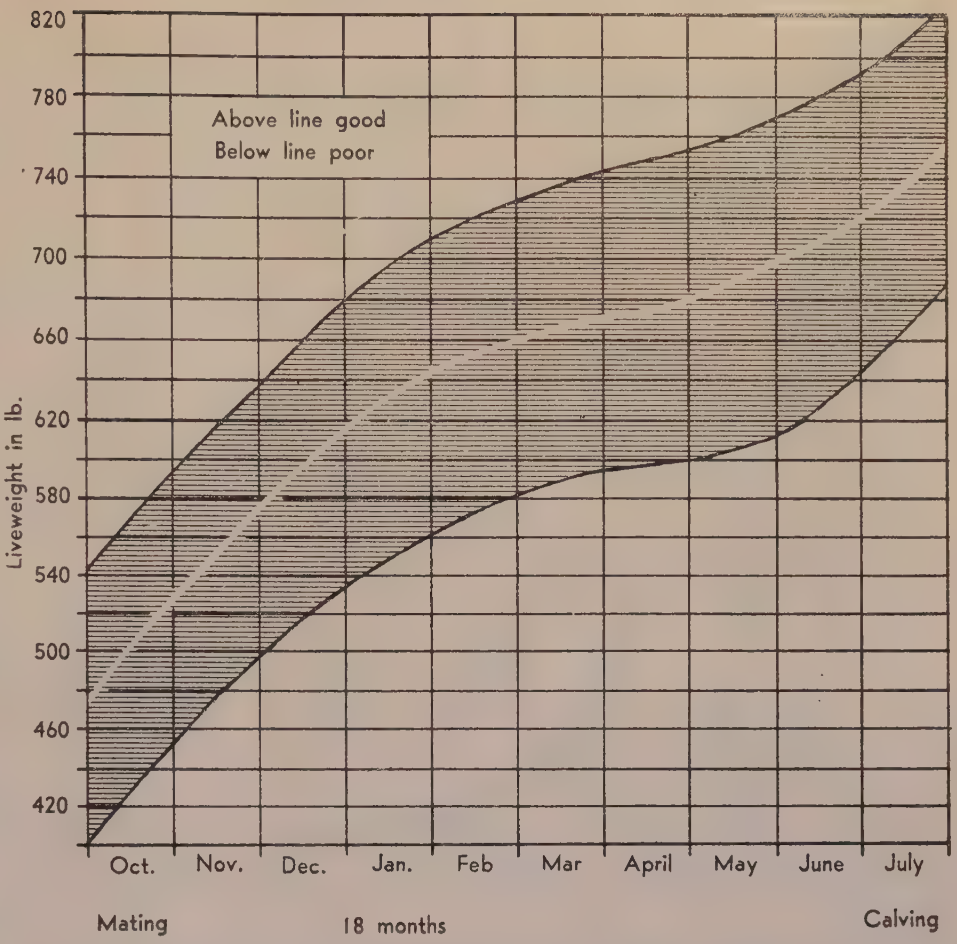

Fig. 1—Growth curve from mating to calving. For good growth for rising 2-year-old Jersey heifers the middle curve or above should be aimed at. Production will suffer in animals whose weights fall in the shaded area below the middle curve.

Other Diseases of Calves

Less commonly than those already dealt with in the appropriate sections as major disease risks at particular periods, several causes of ill health may affect dairy stock at any stage. The more important of these are briefly described below.

Blackleg

Blackleg is a highly fatal disease of young stock. It is most common between the ages of 3 months to 6 months. It is caused by an organism present in the soil. The disease is distributed widely in Taranaki, Northland, South Auckland, and Waikato.

Onset is sudden. Animals are usually found dead, though the early symptoms of lameness with fever and marked general depression may be seen. Swelling of muscles is the most characteristic post-mortem symptom. This develops most frequently in the muscles of the shoulder and hindquarter. The skin over the affected areas becomes dark and parchment-like; cutting into the affected muscles releases foul smelling gas and fluid.

Where the presence of this disease is suspected veterinary advice should be sought without delay. Losses from blackleg may be readily prevented by vaccination. This procedure should become a routine on any farm where losses from the disease have occurred.

Tuberculosis

Tuberculosis is not inherited. The majority of cases of tuberculosis contracted by calves under 6 months of age are considered to result from the feeding of infected milk. In yearlings and 2-year-old cattle the disease is contracted by contact with cases of tuberculosis in adults.

The diagnosis of tuberculosis in young stock is difficult on clinical grounds alone and can be made with certainty only by a tubercular test.

No treatment is available. Control is possible only by the adoption of regular tuberculosis testing and the slaughter of all reactors so that a tuberculosis-free herd is built up. It is essential that no animals should be introduced to such a herd that have not passed a tuberculosis test. Tuberculosis is a notifiable disease and its control is the responsibility of the Animal Industry Division, Department of Agriculture.

Lead Poisoning

Lead poisoning is by far the most common form of metallic poisoning in

Other Diseases of Calves

1. Blackleg can be prevented by vaccination, which must be a routine procedure on infected farms.
2. Tuberculosis can be eliminated only by the regular testing and slaughter of reactors to build up a tuberculosis-free herd.
3. Lead poisoning is one of the most common causes of accidental death. The use of lead paint on farms should be avoided.
4. Ringworm is common in older calves. Treatment is easy and effective.
5. Coccidiosis can cause heavy losses. Veterinary diagnosis and advice are essential in its control.
6. Lice are common parasites of young cattle. They can be eliminated by spraying with modern insecticides.
7. Copper deficiency can cause unthriftiness. It is easily corrected by topdressing with copperised superphosphate.

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calves. Young calves are especially susceptible. Only very small amounts of lead are needed to produce fatal results. Probably the most common source is the licking of flakes of lead paint from gateways. It is not necessary for the paint to have been newly applied. Farm gates painted many years before have been chewed by dairy stock with fatal results.

Death from poisoning is usually rapid. Calves are often found dead with no history of illness. The calf may, however, show symptoms of epileptic-like fits after periods of dullness and dejection, grinding of the teeth, blindness, and evidence of abdominal pain. Aimless walking in circles is sometimes observed. The whole picture is one of mental derangement. In all cases of fits and sudden deaths in calves lead poisoning should be suspected and veterinary confirmation sought.

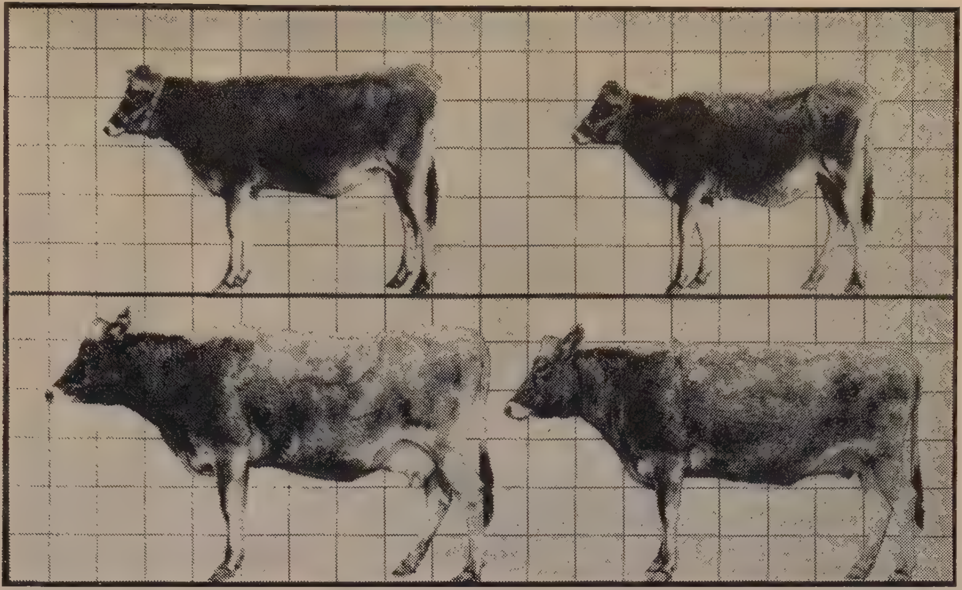

Fig. 2—Poor rearing methods can produce permanent ill effects, as shown by this pair of identical twins photographed at 6 months and at 4 years. Left—Rotationally grazed. Right—Set stocked.

The chemical antidote to lead poisoning is magnesium sulphate (Epsom-salt) given by the mouth in amounts up to 6oz. Calves suspected of having consumed lead should be drenched promptly.

Ringworm

Ringworm, a fungous skin disease of calves, is widespread. Weaned calves and yearlings are most frequently affected. The disease causes typical round scaly patches from ½in. to 2½in. in diameter with grey, dry, crusty surfaces, especially round the face, ears, and neck. Infection is contracted through either direct or indirect contact. It is believed that ringworm spores can persist on fences, trees, bails, etc., for an indefinite period and thus become transmitted to each fresh crop of calves. Ringworm infection may be transmitted to the human being and care should be taken in the handling of calves while they have the disease.

Frequently spontaneous recovery occurs, especially during bright, sunny weather, in calves kept outside. Ringworm responds fairly promptly to treatment. Numerous remedies are used according to personal preference, but it is generally recognised that thorough scrubbing of the areas with hot washing soda solution (one handful to a bucket of hot water) to soften and remove dead skin and hair, followed by the application of strong tincture of iodine, is as good a treatment as any.

Coccidiosis

Outbreaks of coccidiosis may occur in young calves between the ages of 6 and 12 weeks. The cause is a single-celled organism which sets up an intense irritation and inflammation in the bowel wall. Symptoms include foul-smelling diarrhoea containing blood and mucus. Appetite is lost and there is marked straining. The animal may stand for long periods with arched back. It soon becomes anaemic, weak, and emaciated.

It is probable that all cattle harbour a small number of immature forms of coccidia and thereby acquire an active resistance. The organism is also widely distributed in pasture and buildings and is able to live apart from the animal for considerable periods. It is only when a massive infestation occurs under bad calf rearing conditions that cases occur. Several drugs are very efficient for treatment. This disease requires veterinary diagnosis, so that professional advice should be sought if coccidiosis is suspected.

Lice Infestation

Lice pass their entire lives from eggs ("nits") to adults attached to the animal. They do not long survive removal from it. Eggs hatch in approximately 2 weeks and adult insects may start to lay eggs in a further 2 to 3 weeks.

The number of lice present is related to the nutrition of the calf, with poorly reared animals affected to a greater degree. They are most abundant in late winter and spring. The favourite locations for lice are the head, back, and inner surfaces of the thighs. Irritation caused by lousiness may be intense, causing rubbing and licking of the skin and restlessness of such proportions that nutrition and growth are retarded. The modern insecticide B.H.C. as used in sheep dipping is effective in killing lice. Its residual effect is also very good, so that lice hatching out later are also destroyed.

The modern spray dip used for the control of external parasites in sheep is also excellent for treating calves infested with lice. Since these, however, are seldom available to dairy farmers, hand spraying has to be resorted to. This will be effective only if care is taken to wet the calf completely. The efficiency of control of external parasites depends just as much on effective application as it does on the direct killing action of the insecticide used.

Trace Element Deficiency

Two important trace element deficiencies may be experienced in New Zealand calf rearing. The first, cobalt deficiency, has been widely publicised for many years. Areas likely to be affected with "bush sickness" are well defined and known to most farmers. Any office of the Department of Agriculture can provide information on affected areas in its territory. Topdressing with cobaltised superphosphate is completely effective. Since this practice is universal in all zones known to be affected and since consequently the disease has disappeared, no detailed description of bush sickness is given in this article.

The other important trace element is copper, which is likely to be deficient in pastures grown on peat soils or mixtures of peat and pumice or peat and sand.

The main symptoms of copper deficiency in young cattle are unthriftiness and retarded growth. Where copper deficiency is complicated by the presence of excess molybdenum profuse scouring occurs, especially in winter and spring, and deaths among yearlings are common. Affected calves over 3 months old have very fragile bones which fracture easily. Copper deficiency is best corrected by topdressing with copperised superphosphate. Young cattle showing acute symptoms may be cured by drenching with a solution made by dissolving 1oz. of copper sulphate in 1 gallon of water. The dose is 1 pint and this should be repeated at 2-day intervals. Five doses should be sufficient to cure the scouring, but topdressing is necessary to ensure continued thrift.

Acknowledgments

This series of articles, which is based largely on the work of the Ruakura Animal Research Station, could not have been written but for the sound work of J. C. Percival, F. T. Lees, and W. H. Bishop, of the Station's staff. Photographs and graphs have been prepared by J. H. Gibson and B. H. Millar. The writer's thanks are due to all these officers.

Book Review

"The Life and Times of Sir James Wilson of Bulls": L. J. Wild

BIOGRAPHICAL writing has not attracted a great deal of interest in New Zealand and, with a few notable exceptions, that which has appeared has been little more than a collection of family chronicles. Mr. L. J. Wild's biography of Sir James Wilson is of interest for a number of reasons. It is devoted to the life of men who played an important part in the development of agriculture, agricultural organisations, and particularly agricultural education. It is not so much devoted to the struggles of the pioneering period, though when Wilson took up Ngaio Station it was still a mass of scrub and swamp; the most interesting and important part of the book is the description of Wilson's activities between 1900 and 1920, a period in New Zealand history often thought of as uninteresting and dull. Yet it is a period when a number of more modern institutions and ideas were first taking shape.

JAMES GLENNY WILSON was born in 1849 and came to New Zealand in 1873, when he took up Ngaio Station near Bulls. Over the next 20 years his energies were in part devoted to developing the property at a time when wool prices were low and the prospects for the future not by any means hopeful. At the time these experiences were shared by thousands of other New Zealand farmers, most of whom had to struggle on without any of the financial help that Wilson received. One gains the impression that Wilson, though keeping up to date with new ideas and techniques and being among the first to try them, was perhaps inclined to ignore the details. Mr. Wild remarks that Wilson was not suited temperamentally and physically to the task he had set himself. But if his own place did not receive justice, his contribution to the progress of agriculture in the country as a whole is of much greater intrinsic importance than his efforts at Ngaio.

Parliamentary Career

His first important venture into public life was his election to Parliament in 1881. His parliamentary career lasted until 1896 and whatever way one looks at it his record was undistinguished. He made few contributions to debate, even when subjects closely related to agriculture were being discussed. He also gave the impression that he had no settled political convictions and though this enabled him, though a large landowner himself, to see the merits of McKenzie's land reforms, it must have excluded him from any position of importance in politics.

Mr. Wild divides his book into two parts—"The First Fifty Years" and "The Years of Service". This division is a sound one, for it was in the latter part of his life that Wilson devoted himself to three causes: The Farmers' Union, the Board of Agriculture, and agricultural education. Wilson was elected president of the Farmers' Union at its first national conference in 1902 and retired in 1920. The history of the union and its political role requires a book in itself, but Mr. Wild traces the story of its growth in power and influence. Wilson was an ideal president, for he was acceptable to both large and small farmers and his devotion to the task of improving agriculture was known to all.

Board of Agriculture

The Board of Agriculture is largely forgotten today, but it is of interest because it was a form of administrative organisation that has not proved very successful in this country. It was created in 1914 and held its first meeting in June of that year. Wilson was appointed its first president. Mr. Massey (then Prime Minister) detailed its duties, which were to advise the Minister of Agriculture on all problems connected with the prosperity of the industry and, significantly, "with the marketing of its products". It seems inevitable that an advisory body will come into conflict with those who have the task of translating policy into action, and relations between the board and the Department of Agriculture were not the happiest. The board was keen to see the Department reorganised, but it should be emphasised that the Department's shortcomings were due to the lack of scientific knowledge and the lack of qualified men to undertake its work. Though the board did much useful work, it sank into the background in the 1920s. Wilson was growing older and the board was not equipped to tackle the complex economic problems that were coming to the fore.

Among other things the board devoted a good deal of attention to agricultural education and research and no other subject was nearer Wilson's heart. Mr. Wild is naturally interested in these topics and he has already written a brief history of agricultural education. However, this chapter leaves rather uncertain just what part Wilson played in the discussions and controversies of the period. The complex story leading up to the foundation of Massey Agricultural College is sketched and some attention is given to the demands put forward by agricultural societies that agriculture should be given a much more prominent place in primary and secondary school curricula. The progress made here is a matter of debate.

Family Letters

No clear picture of Wilson's personality emerges at any stage in the book except perhaps in the selection of letters at the end. This is in many ways the most interesting section of the book, for it shows how closely Wilson was tied, emotionally and financially, to his father. The father's letters, on the other hand, show him as the traditional Victorian head of the family—dictatorial and unwilling to forgo control over the family's destinies. But the frequent appeals for financial help may well have justified his continual prodding in the interests of efficiency. Nonetheless Mr. Wild might have thrown a little more light on the relationship between the two men. Wilson's book "Early Rangitikei" shows a more light-hearted side to his character and one that must have had some bearing on his ability to get on with others, and perhaps a few extracts from that book might have been included in Mr. Wild's biography.

Whatever reservations one may have about the manner in which the various sections of the book are assembled and the lack of a connecting thread, Mr. Wild has written a book which will remain a valuable work of reference for many years. It is also a tribute to a man to whom New Zealand agriculture owes a great deal.

—*P.R.S.*

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Meteorological Records for April

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
				Absolute maximum and minimum					Maximum fall		
		Approx. mean	Difference from normal	Maximum	Minimum	Total fall	No. of days of rain	Difference from normal	Amount	Date	
Kerikeri	201	59.8	−1.3	78.6	35.5	5.34	14	−0.26	2.75	20	154.7
Auckland	160	60.2	−1.1	75.4	42.3	3.53	14	−0.86	2.15	20	143.8
Tauranga	10	57.9	−0.6	74.0	34.8	5.10	13	+0.08	3.18	20	144.6
Ruakura	131	55.3	−1.3	72.9	26.7	4.65	12	+0.91	2.40	20	149.1
Rotorua	975	54.7	−0.7	71.5	30.7	5.56	10	+0.93	1.98	20	133.6
Gisborne	12	56.5	−1.4	77.8	36.8	11.13	17	+7.47	3.61	20	116.0
New Plymouth ..	160	57.4	−0.7	69.8	36.2	2.76	14	−2.02	0.97	13	170.1
Karioi	2125	50.0	−0.4	70.5	26.8	3.83	15	+0.01	0.70	20	
Napier	5	58.4	−0.1	79.0	33.9	3.91	11	1.28	1.13	20	136.2
Wanganui	72	57.4	−0.1	75.6	37.4	1.65	10	−1.15	1.13	18	139.5
Palmerston North .	110	55.9	−0.7	73.5	32.0	1.28	10	−2.08	0.69	18	130.1
Waingawa	340	54.4	−0.1	72.1	29.7	2.74	15	−0.16	0.65	11	134.8
Wellington	415	54.0	−2.1	66.0	41.2	3.85	16	+0.04	1.16	13	127.4
Nelson airfield ..	5	53.0	−1.1	70.0	27.0	1.72	9	−1.23	0.57	10	202.5
Blenheim	12	54.2	−1.3	73.6	31.0	2.03	7	−0.01	1.20	11	190.9
Hokitika	15	51.0	−1.9	65.2	32.8	3.06	12	−5.77	1.16	7	175.6
Hanmer	1270	49.5	−2.0	72.0	25.0	2.78	13	−0.56	0.54	1	123.3
Christchurch ..	22	52.6	−0.9	80.6	30.0	1.45	9	−0.40	0.63	23	155.6
Ashburton	323	52.6	+0.0	78.0	27.0	1.70	7	−0.71	0.92	13	147.6
Timaru	56	53.0	+0.0	72.2	30.6	1.24	8	−0.42	0.58	13	159.4
Alexandra	520	48.6	−2.5	73.8	25.9	0.70	7	−0.65	0.26	13	159.3
Taieri	80	49.0	−2.3	75.9	25.2	2.08	12	−0.02	1.16	13	144.7
Invercargill airfield	0	47.8	−2.1	68.9	25.2	2.19	19	−1.53	0.53	12	112.0

HEADING PHOTOGRAPH: Analyses of plant samples from the experimental plots at Rukuhia aerodrome have provided valuable reference data.

Plant Analysis as an Aid in Advisory Work

By K. J. McNAUGHT, Agricultural Chemist, Department of Agriculture Soil Research Station, Rukuhia

THOUGH soil analysis is the main technical aid to instructors of the Department of Agriculture in their advisory work, use is also made of plant analysis for special purposes, such as determining the specific deficiencies or toxicities responsible for unsatisfactory plant growth. In conjunction with soil tests, plant analyses have proved particularly valuable in unravelling complex plant nutritional problems.

THE most important methods of determining fertiliser and lime requirements of soils are field experimentation, pot or culture experiments, soil analyses, and plant analyses. In special research projects all four techniques may be employed, but for an advisory service handling large numbers of inquiries speed and convenience of operation become dominant considerations. In general, soil analysis is considered the most practicable basic method. Plant analyses, however, have much to commend them, and are being employed especially as a supplement or adjunct to soil analyses. They are particularly useful where a cross-check is required, or to extend the information supplied by soil analyses.

Theory

When climatic and soil conditions are favourable and disease is not a factor plants will grow to the extent that supplies of plant foods will allow, until they reach a peak or optimum growth. If a nutrient is in short supply, growth will be restricted by this limiting factor. If plant samples from a soil deficient in a plant food are analysed and the results compared with those of samples from adjacent blocks on the same soil treated with increasing amounts of the appropriate fertiliser, it will be found that the uptake of the plant nutrient increases with increasing yield. Beyond a particular rate of application the plant will no longer respond to further additions of the fertiliser, but it still takes up increased amounts of the nutrient. Thus if an excess of fertiliser is applied, the uptake may continue well beyond the limit of the plant's needs, even ultimately to the extent of causing serious injury or death when the protective mechanisms break down. This continued absorption of nutrients beyond a plant's needs and the rise in concentration as a deficiency is remedied make it difficult to determine the "best" levels of all the plant nutrients within plant tissues, especially as different groups of plants or even varieties of the one species of plant may have different requirements of certain nutrients, especially the trace elements.

Criteria

To utilise plant analyses for determining the cause of unsatisfactory growth the "critical" level in plant tissues at which a response can no longer be expected from applications of the particular plant food needs to be known. To arrive at such key reference levels it is necessary to relate plant analytical figures to results of field experiments with different rates of a particular fertiliser under conditions when all other plant nutrients are in sufficient supply. It is not enough to use one reference plant or plant association, such as a grass-clover pasture, but it is desirable to establish criteria for all important plant types—a formidable task.

Extensive work has been done at the Soil Research Station with this ultimate objective, and fortunately the indications are that it is possible to make fairly broad generalisations for the main constituents in most groups of plants.

Sampling

The age of the tissue analysed has a marked effect on the result, and this applies especially to phosphorus, calcium, and nitrogen. For this reason it is preferable to analyse plant tissue of a particular stage of development, and in work on vegetable or supplementary fodder crops recently matured leaves are considered to be the most suitable; in tomatoes mid-stem leaves.

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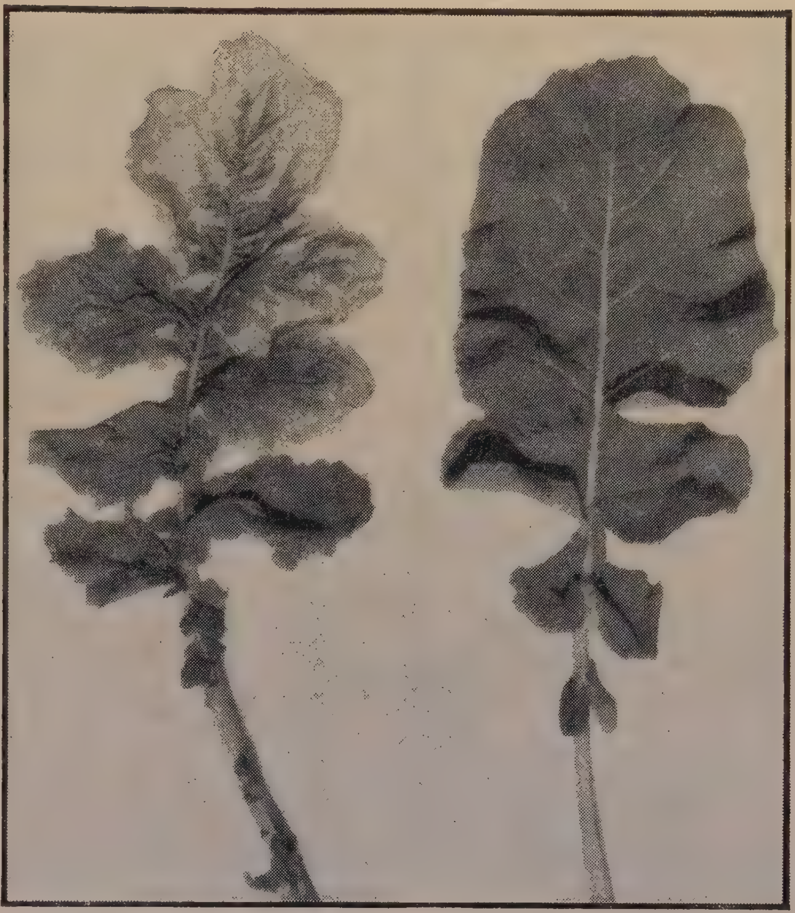

Plant analysis showed the leaf on the left to be potassium deficient.

All the evidence so far assembled indicates that the critical or no-response level for potassium in such tissues in nearly all agricultural plants and vegetables is approximately the same, 1.5 to 2 per cent. of the dry matter.

In pasture work for practical reasons the whole of the above-ground growth from near ground level is taken, preferably at grazing height. For accurate work the grasses and clovers are picked out and analysed separately, not because they have a different internal requirement for plant foods, but because they differ in their ability to utilise the plant foods in the soil. Frequently it is found through plant analysis that the clovers are potassium deficient but the grasses are not. Instead, the latter may be nitrogen deficient. Analyses of a mixed pasture in such cases may give results which are difficult or impossible to interpret.

Crop Differences

Some interesting results have been obtained from experiments on the Horotiu sandy loam, a highly phosphate-fixing yellow-brown loam of volcanic origin. On this soil the plants most susceptible to phosphorus deficiency were beets, swedes, turnips, tomatoes, lettuces, cabbages, cauliflowers, and chou moellier. Rape and clovers were less severely affected and potatoes, parsnips, carrots, grasses, and onions were least susceptible. Even in the last group of plants yields on the plots without phosphorus were only a quarter to half those on the phosphate-treated plots. Plant analyses have confirmed that grasses, for example, are more efficient at securing their requirements of potassium and phosphorus from this soil than clovers, and much better than beets and brassicas.

Comparison of Soils and Plants

When soils are analysed, for example to determine their phosphorus-supplying power, the result is recorded as a numerical figure, which is quite independent of the crop to be grown. Responses depend to some extent on soil type, but in general large responses of pastures to phosphate fertilisers are usual with tests below 3, moderate below about 8, and no responses are expected above about 12 to 15. As clovers are less efficient at securing their phosphorus requirements than grasses, the soil test level aimed at, above 12 to 15, is primarily for the benefit of the clover. If grass only were to be grown, a test of about 6 to 8 would be sufficient in many cases. At the other extreme tests of 20 or more may be required for plants with the least ability to absorb phosphorus from the soil, such as the beet and brassica families. This means that **different interpretations** should be placed on a soil test level, according to differences in the plants' abilities to utilise the available foods, but only the **one** soil analytical figure for phosphorus is recorded. The interpretation is usually left to the judgment of the Instructor in Agriculture or Horticultural Instructor. In plant analytical work, however, the figure obtained will vary according to the type of plant analysed. Thus, on a soil testing 5 for phosphorus the phosphorus level in the dry matter of whole leaves may be found to be 0.25 per cent. in ryegrass, 0.20 per cent. in white clover, and 0.15 per cent. in swedes or cabbage. All three groups, grasses, clovers, and brassicas, appear to require about 0.30 per cent. of phosphorus for maximum growth; hence plant analysis clearly gives a different emphasis from soil analysis. Plant analysis gives a more **specific** indication. It tells the amount of the nutrient the particular plant analysed has actually been able to obtain from the soil. Soil analysis, on the other hand, gives a **generalised** picture which has to be interpreted for the particular purpose for which the land is being utilised. Special knowledge is required to enable reliable interpretations to be made, and this is one of the reasons why the use of soil test kits by farmers or market gardeners is not recommended. When plant analyses are used the results must be interpreted in terms of the nutritional requirements of the specific crop analysed, and the conclusions will not necessarily be applicable to all other crops.

To summarise the above observations it may be said that soil analyses give a simplified over-all picture of the nutrient supplying ability of soils and that plant analyses reflect not only the supplying power of the soil but also the relative efficiency and total demand of the particular plant analysed. Soil analyses point to possible deficiencies; plant analyses to actual deficiencies. The combination of both is therefore particularly valuable, because from plant analysis the actual deficiency limiting growth can be found and from soil analysis the likely further deficiencies which may appear after the severest deficiency has been corrected.

Application

Some examples of the application of plant analyses will illustrate their value. In an article in the October 1953 issue of the "Journal" on the "Soil Advisory Service of the Extension Division" E. B. Davies, Senior Chemist, Department of Agriculture Soil Research Station, Rukuhia, explained why soil analyses for nitrate and ammonia are liable to be misleading. The accurate determination of the nitrogen-supplying power of soils is a lengthy process, quite unsuitable for routine work. Plant analyses offer a practicable alternative for agricultural crops and vegetables. Quick tests for nitrate in plants are particularly valuable for succulent types of plants such as brassicas, beets, tomatoes, and lettuces. For pastures, however, they are of limited value, as the clovers secure a substantial part of their nitrogen supplies through the root-nodule bacteria and it is considered that grass roots in intimate contact with clover roots may obtain an important part of their nitrogen requirements as aminoacids or amides excreted by the nodule bacteria. The nitrate test does not detect such forms of nitrogen. For these reasons the nitrogen status of legumes or of grasses in a grass-clover pasture is usually determined as total nitrogen or crude protein by a slower acid digestion process.

Few deficiency symptoms are sufficiently clear-cut and unambiguous to use on their own. When plant samples showing visual symptoms are submitted by an instructor it is usual to check by analysing for the constituent suspected to be in short supply. If a quick-test method is available for use on the fresh plant tissue, this is tried first. If the suspected cause is not clearly confirmed or if the sample is received in a partly dried state, it is usual to dry the balance of the sample and carry out analyses on an acid extract of the ash. This is where flame photometer and spectrographic facilities have proved so useful in enabling a large number of such analyses to be made. At present nitrogen, phosphorus, and sulphur are determined here by chemical methods, potassium, sodium, and calcium by flame photometer, and magnesium and manganese by the spectrograph. In special cases boron, molybdenum, and copper are determined by rather time-consuming, but reliable, chemical methods, and zinc and iron can be added to this list as required.

Plant analyses have been of help to officers in various fields of research, for example peat development, lime requirements of soils, the role of micro-organisms in soil, phosphate fixation, and in detailed studies of the effect of potassium deficiency on pastures. They have been of particular value in explaining the appearance of deficiency or toxicity symptoms or unexpected results in pot experiments and field trials.

In general advisory work various deficiencies and toxicities have been revealed, such as unsuspected potassium deficiency in onions, cabbages, cauliflowers, and carrots, nitrogen deficiency in various fodder crops and vegetables, boron deficiency in clovers, lucerne, brassicas, and celery, manganese deficiency in vegetables on sandy and peaty sand soils, magnesium deficiency in tomatoes and grapes in spite of apparently adequate soil tests, phosphorus deficiency in tomatoes on a very high-testing soil, and manganese toxicity in nursery seedling plants in spite of apparently satisfactory soil pH tests.

In most of these cases a clear picture of the problem has been obtained only through the combination of plant and soil analyses. Magnesium deficiency in glasshouse tomatoes provides a good example. The soil tests frequently indicate that magnesium is in plentiful supply, yet plant analyses show very low levels. The trouble cannot be due to a simple magnesium deficiency, because plants usually fail to respond to heavy soil dressings of the soluble fertiliser magnesium sulphate, and only spray applications to the foliage are really effective. All the evidence indicates that something is preventing the plant from taking up sufficient magnesium from the soil, in spite of high soil tests and added magnesium fertiliser.

Soil tests show extremely high potassium tests and usually very high soluble salts, two potent factors which can seriously interfere with plant uptake of magnesium. Overseas pot culture work has shown that high potassium levels reduce the uptake of magnesium by plants. The ability of plants to take up foods selectively is very limited, and absorption tends to be in proportion to the amounts available in the soil. The normal practice in tomato glasshouses has been to apply very heavy dressings of potash; hence the ratio of plant-available potassium to magnesium in such soils is usually very high and often quite out of balance. The result is a "potassium induced" magnesium deficiency. In practice, instead of an attempt being made to remedy this type of deficiency solely by use of magnesium fertilisers or sprays, it would be sounder to reduce the amount of potash fertiliser and flood the soil to eliminate soluble fertiliser residues. Sound practical advice on complex problems such as this may be difficult, if not impossible, without the aid of **both** soil and plant analyses.

☆

Book Review

"Feeding Farm Animals in Australia": A. C. T. Hewitt

IN spite of the numerous books that have been written about the feeding of livestock, there are few or none that can be recommended without qualification to the New Zealand farmer. Most have been by authors accustomed to the production of livestock under either American or prewar British conditions, where dairy cattle at least are normally housed and fed indoors over a substantial part of the year.

As the title of his book indicates, Mr. Hewitt has been concerned particularly with the problems and practices of feeding farm livestock under Australian conditions, where, as in New Zealand, pasture and its products are the feeds of predominant importance. Mr. Hewitt outlines the basic concepts of animal nutrition and the principles that should govern the compounding of rations, but he shows himself very well aware of the difficulties confronting the farmer in applying these concepts and principles in countries where stock are maintained almost solely on a diet of pasture grazed by the animals themselves.

"Feeding Farm Animals in Australia" is a book of some 250 pages. The first part of it deals with the way in which animals gather, digest, and utilise their food, and with their requirements for water, for minerals, and for organic feeds. Then there are chapters concerned with the methods traditionally used in evaluating feedstuffs and with the relative value of the different feedstuffs available to stock in Australia. Pasture and its derivatives, cultivated crops, and concentrates all receive attention, and even trees and shrubs. The latter half of the book deals with the feeding of the main classes of farm animals. Dairy and beef cattle, sheep, pigs, and poultry are each dealt with in some detail. Goats, dogs, cats, ferrets, and rabbits are also mentioned. Throughout the approach is essentially practical. Mr. Hewitt does not recommend practices which do not pay. He provides many useful and interesting tables, as, for instance, a novel one which gives the weights of various stock feeds that are held in a 7lb. jam tin and a 2lb. fruit tin.

In spite of the pleasing emphasis on pastoral farming, the book has disappointingly little to offer the really progressive New Zealand fat lamb or dairy farmer. Much of the chapter on feeding sheep is devoted to discussion of the ways and means whereby sheep losses during droughts may be reduced from catastrophic to moderate proportions. The emphasis is on keeping the animals alive rather than on feeding for increased production. The practice of "flushing" is not even mentioned. In the chapter on feeding dairy cattle there is no mention of the electric fence nor of autumn-saved pastures. These surely are serious omissions. Recommendations in respect to calf rearing, too, seem rather old fashioned, for the practice of early weaning of calves is not discussed. In general one is left with the impression that the New Zealand dairy farmer is well ahead of his Australian counterpart in respect to techniques of grassland management, and this impression is strengthened when Mr. Hewitt makes reference to a dairy herd of 320 cows grazing in a 1000-acre paddock!

The basic problem of feeding livestock in a grassland environment is one of equating the needs of animals to a fluctuating feed supply. In this connection Mr. Hewitt has a really big problem on his hands and perhaps the strongest feeling with which the New Zealand farmer who reads this book will be left will be one of profound thankfulness that he is farming under New Zealand rather than Australian climatic conditions.

—*L.R.W.*

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Use of V Drains on Sand Country

THE conventional type of open drain with battered or straight sides on sand country is easily trampled down by stock and requires constant and costly maintenance by hand. Mechanisation has made it possible to construct broad shallow V drains on such country which, when successfully grassed, require little or no maintenance. Whereas open drains through a paddock restrict normal farm operations, properly constructed V drains are easily negotiable by farm implements and tractors. V drains are also being used extensively in the improvement of the drainage of silt and clay flats.

—*E. W. S. WILSON,*
Fields Instructor,
Department of Agriculture,
Palmerston North

The Science of Milking Cows

To most dairy farmers milking is a task which has to be performed twice a day, 7 days a week, for at least 10 months of every year of their working lives. To W. G. Whittlestone, Physical Chemist, Department of Agriculture Animal Research Station, Ruakura, the milking of cows is a science, and some of his findings at Ruakura should prove useful to dairy farmers.

A COW'S udder consists of three parts—the teat, the cistern or cavity above the teat, and the rest of the udder, which is a complicated apparatus in which milk is made from the constituents brought to it in the blood. The cistern can hold only a small proportion of the milk in the udder at milking time, and it is only the milk in the cistern which can be removed either by hand or machine milking or even by a calf. The rest of the milk can be obtained only if it is forced into the cistern during milking. The udder will do this only if it is stimulated by the let-down hormone, which is secreted by the small pituitary gland located in the brain. The pituitary gland will secrete the let-down hormone only when the cow is treated in the right way. The calf starts this let-down process by butting at the udder when starting to suckle. The dairy farmer imitates this when he washes the udder before putting on the cups. In many cows the routine in the milking shed is sufficient to stimulate let-down, and it is therefore important not to vary this routine.

Let-down occurs from 20 to 30 seconds after effective stimulation, and it lasts for from 2 to 10 minutes. Let-down can be interfered with by disturbing or frightening a cow and it can be stimulated again after the cow gets over her fright.

Milk Flow Indicators

To find out how these processes affected the rate of milking, and perhaps even the amount of milk produced, Mr. Whittlestone devised a most ingenious milk speedometer. This is an automatic electrical device which records in the form of a graph both the rate of milking and the total milk removed from the udder. The graph of a typical milker is shown in Fig. 1. Each dot represents ½lb. of milk. The total milk can be measured by counting the dots; the time is represented by the distance of a dot from the left-hand vertical line and the speed of milking by the steepness of the dotted curve. Such a device would of course be much too complicated, as well as too expensive, for a dairy farmer. A simpler instrument was therefore designed and this is now available in a commercial form known as the Ruakura Milk Flow Indicator. This device has a chamber with a circular window. When milk is flowing at the rate of more than 1lb. per minute the chamber is full of milk. When the rate falls below 1lb. per minute the chamber begins to empty, and at less than ½lb. per minute it is empty, as shown in Fig. 2.

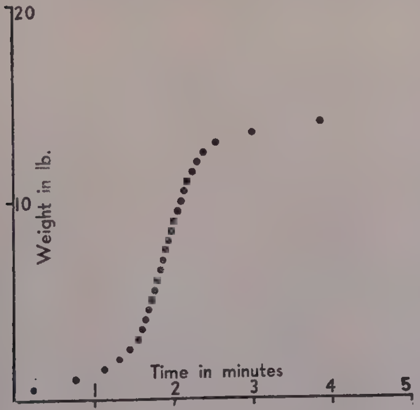


Fig. 1.

By the aid of this device a farmer can tell with considerable accuracy how each of his cows delivers her milk to the machine, and he can adjust the milking procedure accordingly.

The Ideal Milker

When the cups are put on to an ideal milker (and there are a few) the milk flow indicator rapidly fills with milk and remains full for 2 to 4 minutes and then empties. If the cups are pulled down, the indicator remains empty, showing that the cow has milked out and that there are no strippings. The cups can therefore be removed at once.

The Average Milker

With the average cow, the indicator fills rapidly, remains full for 3 to 4 minutes, and then begins to empty. If the cups are then pulled down, the indicator refills and after a short time empties again. In these instances the slowing up is due to the teat cups crawling up the teats and closing the entrance to the cistern. Pulling them down enables the milk left in the cistern to be removed.

The Stripper

In a few cows when the cups are pulled down it is necessary to massage the udder vigorously to obtain some milk which has not been let down into the cistern. This machine stripping should be reserved for cows which need it.

Inadequate Let-down

Sometimes when the cups are put on, the indicator will remain empty for perhaps 2 minutes and will then fill rather slowly. This probably means that the let-down process has not been properly stimulated. Cows vary considerably in the amount of stimulation they require, and the good dairy farmer soon learns which cows need a little extra attention. Taking a squirt or two of milk may help, and if it is taken into a strip cup, it is useful for detecting early signs of mastitis. Late in lactation cows may need more starting than when in full profit. A little extra washing in any case helps to remove some of the autumn mud.

The Effect of Fright

When a cow has been frightened before milking, the indicator may remain empty for up to 4 or 5 minutes, as the milk is not let down until she recovers from her fright. As Mr. Whittlestone is fond of saying: "There is no place in the milking shed for yapping dogs, bad-tempered milkers, or garrulous visitors."

Double Let-down

Occasionally when the cups are put on, the indicator rapidly fills, but after 2 or 3 minutes it empties, though if it is left on, it fills again after 1 or 2 minutes' delay. This is usually caused by the cups having been put on too long after washing. The let-down in such cases does not last long enough to get all the milk and it is necessary to wait for a second let-down. Some cows always show this double let-down, but in most cows it can be prevented by putting the cups on immediately after washing. Washing all the cows in the shed before putting the cups on to the first one is not good practice.

The Tough Milker

With the tough milker the milk will probably flow fast enough to fill the indicator, which remains full for 5 minutes or more. Tough milking is usually due to a small teat opening, and nothing can be done about it. Both tough milking and double let-down appear to be inherited and it is therefore unwise to keep calves from such cows.

Efficient Milking Pays

The intelligent use of the milk flow indicator will save a lot of time in the

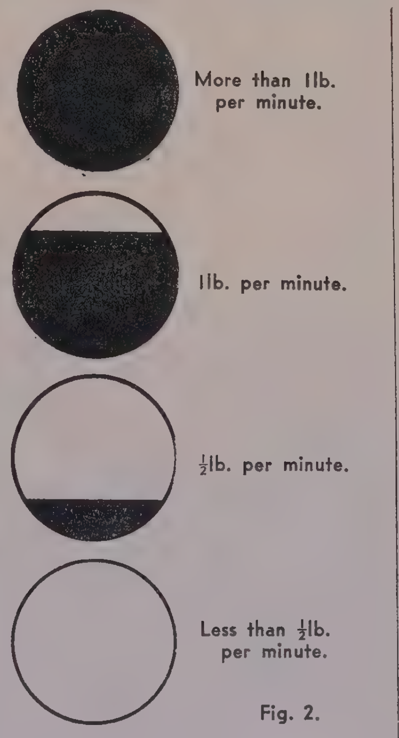


Fig. 2.

shed. Its use in association with an efficient, well-kept machine will ensure that cows give all the milk they have produced. It has been suggested that the difference between good milking and bad milking can be the saving of 15 to 20 per cent. of time in the shed and an increase of up to 50lb. of butterfat per cow.

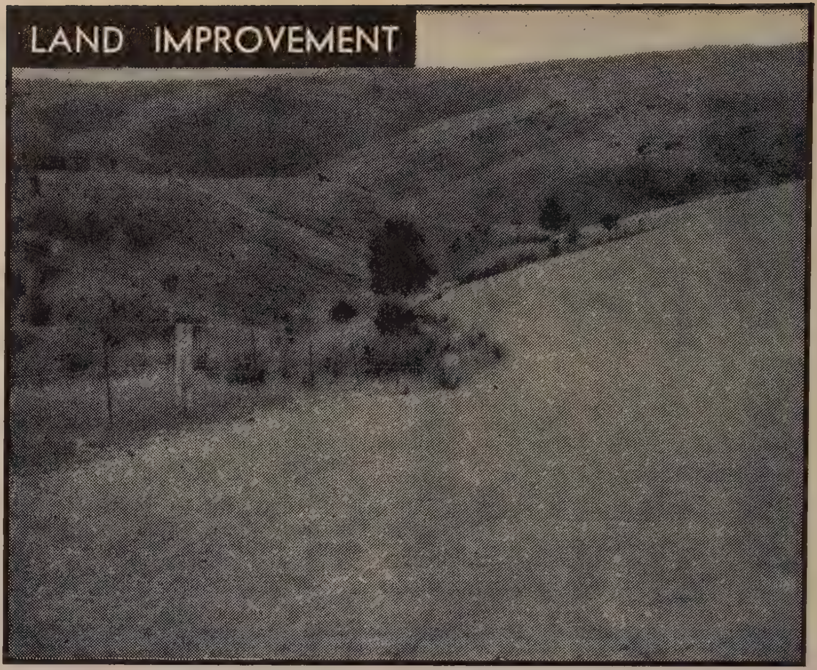
Summary

1. The milk flow indicator enables the dairy farmer to learn the milking habits of individual cows and it assists in their quick and efficient milking.
2. The routine in the milking shed should not be changed.
3. Cups should be put on immediately after washing, which should be more thorough late in the season.
4. Cups should be pulled down as soon as the indicator begins to empty. Vigorous massage should be practised only on those cows which are known to need it. Cups should be removed as soon as they empty after pulling down.
5. Cows should not be frightened before or during milking.
6. Calves from tough milkers or cows with a double let-down should not be kept.

Control of Spurrey in Swedes

A TRIAL on the pre-emergence control of spurrey (*Spergula arvensis*) with T.C.A. (sodium salt of trichloroacetic acid) and I.P.C. (isopropyl-N-phenyl carbamate) was carried out on a farm near Gore during the past season. Treatments were T.C.A. at 5lb., 10lb., and 20lb. per acre and I.P.C. at 1lb., 2lb., and 4lb. of acid equivalent per acre. Treatments were replicated and the trial was laid down on 29 December 1952 on a crop sown the previous day. Eight ounces of seed was ridged with 4cwt. of turnip manure. The location of the plots was on a loamy clay sideling. The soil was dry at time of sowing and this condition persisted. Germination of the swede crop was delayed for several weeks, but spurrey struck and gained a good hold before the swede seed germinated. Applications of 5lb. and 10lb. of T.C.A. had no apparent effect, but the 20lb. treatment showed a slight depression on the growth of spurrey. Again I.P.C. was more effective. Application of 1lb. caused slight depression, 2lb. gave a good measure of control, and the 4lb. application resulted in complete control of spurrey. Unfortunately I.P.C. applied as a pre-emergence spray appears to harm the germination of swede seed. It is possible, however, that poor germination could in a measure be attributed to dry soil conditions. The important feature is that I.P.C. was effective in the control of spurrey, but to determine the effect of I.P.C. on the germination of swede seed further trials will have to be conducted.

—*T. L. REID,*
Fields Instructor,
Department of Agriculture,
Gore



Land Development Practices in Otago

By S. M. J. STOCKDILL, Fields Instructor, Department of Agriculture, Dunedin

FARMERS undertaking land development should now be proceeding with clearing and initial cultivation of areas which are to be broken out of scrub, tussock, or old browntop and chewings fescue for sowing to improved pasture 3 to 4 years hence.

PLOUGHING has proved the most successful first cultivation, but where presence of rock or employment of unskilled labour precludes the use of the plough, giant discing has given satisfactory results at about the same cost.

Where fertility is reasonable a greenfeed crop may, with advantage, be taken on the first furrow, but for best results under poorer conditions land should be fallowed for 18 months, reploughed, limed, cultivated, and sown with adequate fertiliser to Green Globe turnips. These should be followed by a crop of swedes and after feeding off the land should be well worked and if necessary relimed in readiness for sowing to a well-balanced mixture of Certified strains of pasture seeds comprising perennial ryegrass, short-rotation ryegrass, cocksfoot, timothy, Montgomery red clover, white clover, and in some areas crested dogstail and subterranean clover.

Sowing is best and most conveniently carried out in October-November, broadcasting on a rolled surface followed by light harrowing being the most widely used method. Fertiliser practice will vary according to soil type, but the application of adequate fertiliser at sowing will greatly improve pasture establishment, and attachments recently developed for drilling seed and fertiliser together in 3½in. rows have made possible excellent establishment with reduced seeding rates.

HEADING PHOTOGRAPH: Country in the centre and right foreground has been sown to pasture after a crop of swedes. In the background is typical unimproved land.

Modern Methods Aid Development

It is now known that on many Otago soils the benefit from the heavy liming previously considered necessary was associated with the availability of molybdenum. Development on these soils may now be achieved much more economically and effectively by liming at a reasonable rate and applying molybdenum early in the development programme.

Phosphate deficiency is fairly general on newly developed areas and adequate topdressing is necessary to maintain increased production. The ravages of grass-grub and subterranean grass caterpillar have in the past hastened the deterioration of developed pastures, but these pests can now be controlled by the timely use of D.D.T., which is most conveniently applied in a mixture with fertiliser.

Peak production cannot be expected without the provision of adequate shelter, and this aspect of development is far too often neglected.

In recent years aerial sowing has made possible the introduction of clovers to suitable areas of unploughable country and where phosphate (and molybdenum if necessary) have been sown with clover seed during July, August, and September excellent establishment and increased production have resulted.

Recent Research Work

WEEDKILLERS

HEADING PHOTOGRAPH: Ground that is bare of all vegetation 15 months after treatment with C.M.U. in a trial at Rukuhia.

THE most outstanding development in weed control chemicals since the discovery of hormone weedkillers has been made in the soil sterilisation field with the advent of weedkilling compounds based on urea. The older types of soil sterilisers have major disadvantages—arsenicals are poisonous and chlorates have explosive properties. Compounds based on chlorates, made safe with the inclusion of inert materials such as borate compounds, have an efficiency only equal to their chlorate contents. Chlorate compounds have in some trials not proved lethal to grasses even at rates of 2 tons per acre. Borate compounds have not proved particularly toxic to weeds such as blackberry (*Rubus fruticosus*) and *Convolvulus arvensis*. When these materials are used the period in which the soil has remained free of weeds has been comparatively short.

COMPOUNDS BASED ON UREA

HOWEVER, the organic compounds based on urea (C.M.U., P.D.U., etc.) are non-toxic to animals and are relatively easy to apply. Six trials to date comparing the old compounds with the urea compounds show that the urea compounds are many times more toxic per unit than chlorates and borates. In one trial 20lb. per acre of C.M.U. has given better control than 2 tons of borates, chlorates, and mixtures of borates and chlorate. In the same trial 40lb. of C.M.U. has given complete control of all vegetation except for one small plant of paspalum. At 80lb. per acre everything has been killed and after 15 months the ground is still free of all vegetation. At lower rates the urea compounds are selective enough to be employed for crop work. Carrots, onions, lucerne, and potatoes show sufficient tolerance to be weeded with low rates of these compounds. In one trial where C.M.U. had been applied at 4lb. and 8lb. per acre excellent control of weeds was obtained with no apparent damage to potatoes. Further trials are necessary to establish the residual toxicity of these urea compounds in various soils at various rates of application. Susceptible crops planted in areas treated with urea compounds may be destroyed by the carry-over of residual toxicity of the chemical. Preliminary trials have shown that *Paspalum dilatatum* requires up to 60lb. per acre for control and that in general deep-rooted plants such as Californian thistle (*Cirsium arvensis*) are more difficult to kill than shallow-rooted plants. Deep-rooted plants are more effectively controlled with a more soluble form of urea than C.M.U., namely P.D.U. Future trials may show that a combination of these two compounds will give more effective control for certain types of weeds than either used alone.

T.C.A.

To date 76 Divisional trials have been laid down with T.C.A. applied alone or in conjunction with other materials such as I.P.C., chlorates, borates, hormone weedkillers, and phenols. Thirty-three of these trials are completed. The completed trials include 12 trials on pasture weed species, 15 trials on crops, and 6 trials on miscellaneous vegetation such as was found on tracks and ditches. Trials now open include 18 trials on pasture weed species, 12 trials on crops, and 13 trials on miscellaneous or special vegetation such as nassella tussock (*Nassella trichotoma*). The trials on weed grasses and pasture weeds were put down on barley grass (*Hordeum murinum*), tall fescue (*Festuca arundinacea*), fog (*Holcus lanatus*), creeping fog (*H. mollis*), couch (*Agropyron repens*), Indian doub (*Cynodon dactylon*), kikuyu (*Pennisetum clandestinum*), browntop (*Agrostis tenuis*), onion-rooted twitch (*Arrhenatherum elatius* var. *bulbosum*), rushes (*Juncus* spp.), *Paspalum distichum, Carex longifolia, Pennisetum macrourum*, and *Themeda triandra*. Good control was secured with all species except tall fescue and *Themeda triandra*. In all cases rhizomatous grasses were more susceptible than stoloniferous grasses and the established fibrous-rooted grasses were the most resistant. Best control was obtained where the T.C.A. was used in conjunction with cultivation. These experiments showed the need for a follow-up treatment such as cultivation or repeat treatment of T.C.A. if eradication was required; otherwise the small percentage of viable roots left quickly re-infested the area. The crops treated with T.C.A. were lucerne, clover species, brassicas, potatoes, *Phormium tenax*, and linen flax. Potatoes, linen flax, and brassicas showed more tolerance than the legumes, and *Phormium tenax* in the seedling stage was highly susceptible. The work in crops has shown that T.C.A. forms a useful adjunct to cultivation for weed control. Rhizomatous grasses are best cleared by ploughing, cultivating, putting in a resistant crop such as brassicas or potatoes, and applying T.C.A. before crop emergence. Such an application will also keep the crop free of annual grasses, spurrey (*Spergula arvensis*), red root (*Amaranthus retroflexus*), pig weed (*Polygonum aviculare*), fat-hen (*Chenopodium album*), and willow weed (*Polygonum persicaria*). Nassella tussock, being a fibrous-rooted grass, is difficult to kill with T.C.A., but good control has been obtained where the applications have been made after burning. Usually two applications are required for control. Seedling nassella is quite susceptible to T.C.A. T.C.A. is too selective to give a kill of all species growing on footpaths. Clovers and many broad-leaved weeds survive the T.C.A. applications and the period for grass control is short.

APPLICATION OF T.C.A.

Work to date has shown that T.C.A. is best applied in conjunction with cultivation. Best results are obtained if the soil is moist at the time of application and if rain falls immediately after treatment. More T.C.A. is required on mineral clay soils than on soils low in colloidal content, but T.C.A. is leached more readily in light soils than in heavy soils and in wet weather the period of T.C.A. activation in sandy soils is short. T.C.A. has proved with few exceptions a selective grass killer and as such is a valuable chemical for control of weeds not normally killed by hormone weedkillers.

—*L. J. MATTHEWS*

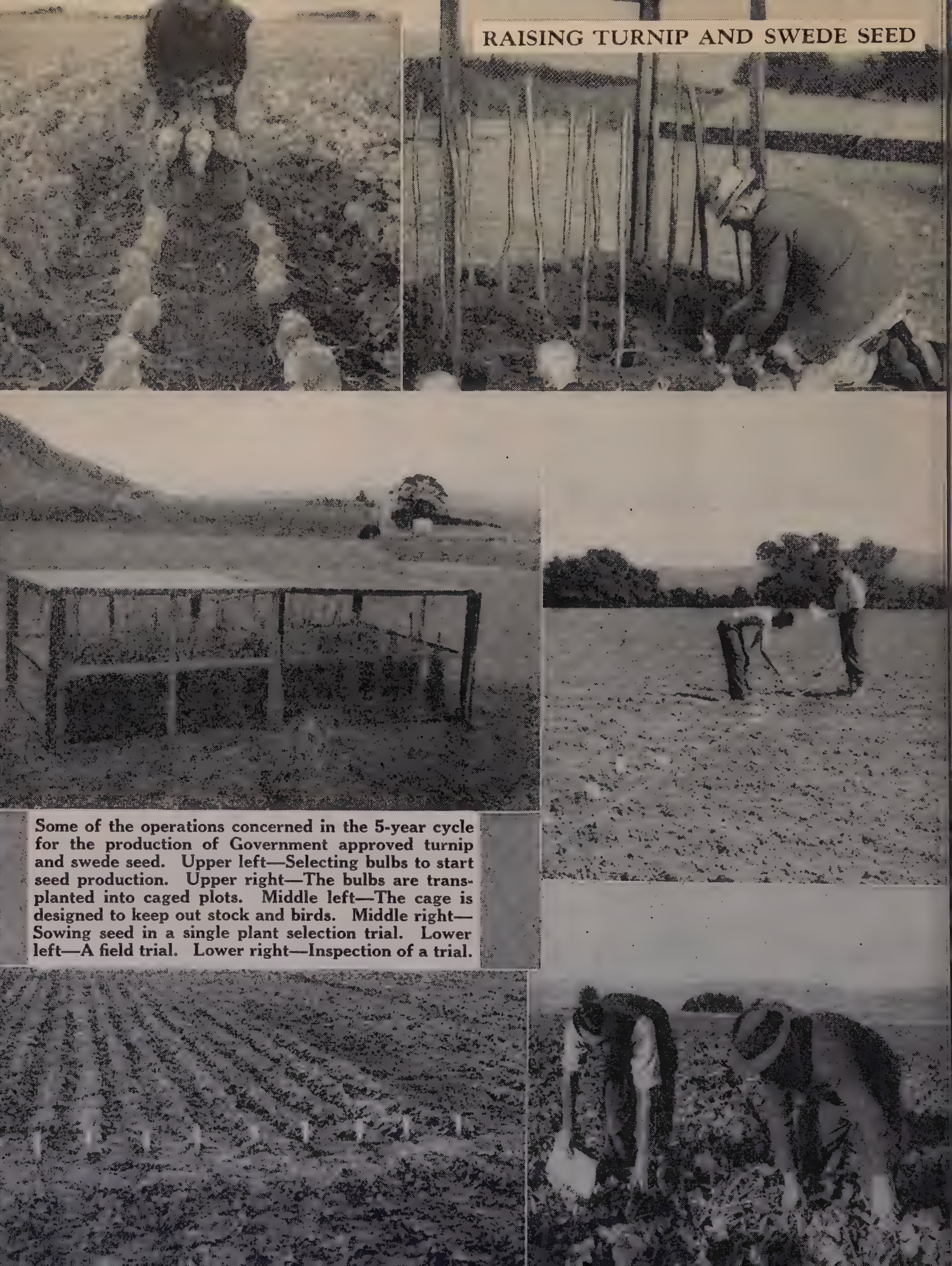
* * * *

PUSSY WILLOWS

PUSSY willows are a problem only where land is too wet to be stocked all the year round. The first step to be taken in the eradication of this pest is therefore the draining of the land. This still leaves the larger pussy willows to be dealt with, as they are beyond the size where cattle can bring them under control. Trials on the Hauraki Plains have shown that such trees can be successfully killed by spraying the boles with the ethyl ester of 2,4-D and diesel fuel at a dilution of 1 in 10. It is necessary to spray the boles from ground level to a height of approximately 3ft. only.

—*G. L. BANFIELD*

RAISING TURNIP AND SWEDE SEED



Some of the operations concerned in the 5-year cycle for the production of Government approved turnip and swede seed. Upper left—Selecting bulbs to start seed production. Upper right—The bulbs are transplanted into caged plots. Middle left—The cage is designed to keep out stock and birds. Middle right—Sowing seed in a single plant selection trial. Lower left—A field trial. Lower right—Inspection of a trial.

Production of Government Approved Turnip and Swede Seed

By J. R. THOMSON, Assistant Seed Production Officer, Department of Agriculture, Dunedin

MOST people are inclined to wonder at the thought and ingenuity which go into the design and construction of a complicated piece of machinery or a large engineering project. Yet how many farmers, as they sow their turnip crop, pause to consider the work involved in the production of such a commonplace thing as the seed for that crop? When they are preparing to sow they ring up their agents and order so many pounds of such-and-such a variety. It is just as easy as that. Yet that seed has been produced only by much thought and hard work. The raising of Government approved turnip and swede seed is essential to many types of farming, and farmers might well be more conversant with the details of its production.

IN the raising of seed to maintain good stock or in an endeavour to improve the strain the important point is to select carefully each year an appropriate number of choice, fully developed bulbs from approved sources, such as field trials on particular crops. Generally this is delayed until the late winter, as by then full scope has been given to the common diseases, particularly dry rot, to become manifest and it is important to know that the bulbs collected at this time have over-wintered without being affected by disease.

Choice of Bulbs

With strains resistant to club root disease the practice is to make the selections only from crops or trial plots on areas known to be infected. Normally this is second crop land, but the degree of infection is determined by the reaction of non-resistant types when grown as controls. If the non-resistant types succumb to the disease, selections from the strain on trial can be taken confidently in the knowledge that they originated from stocks resistant to the disease.

Particular care is given to ensure that the selected bulbs are disease free, true to type, symmetrical, free of undue lateral roots, and with necks fine and in the centre of the crown of the bulb. A greater number of bulbs than required are selected in the first place. The practice then is to lay them out for a second critical examination and by the process of elimination narrow them down to the number required. By this means an exceptionally uniform line of parent plants is obtained.

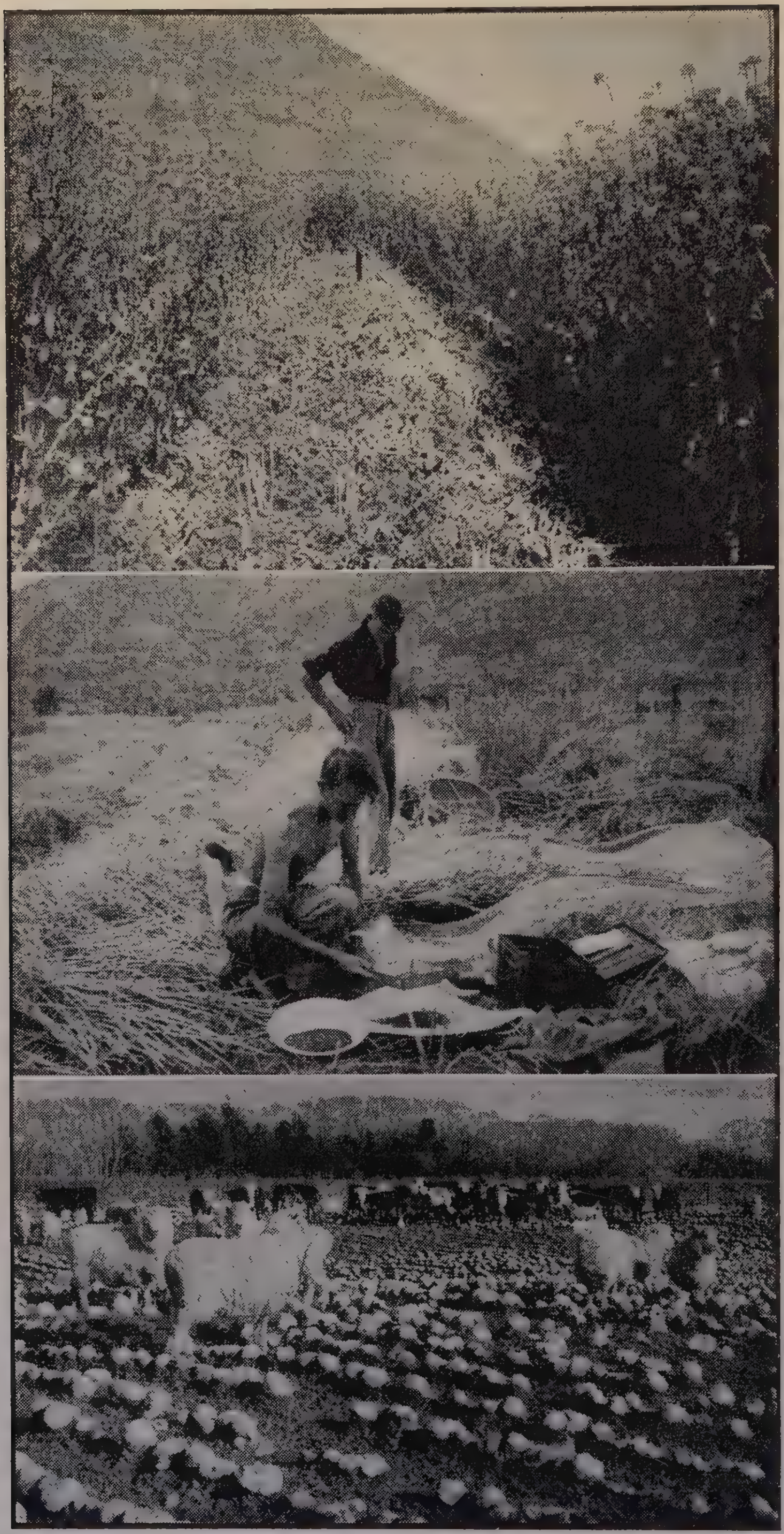
These selected bulbs are carefully packed and removed to the Palmerston district of Otago, where they are transplanted into plots and allowed to go to seed. The plots are protected from the depredations of birds and stock by cages, as shown in the illustrations, and are situated at considerable distances from one another so that cross-pollinations of different varieties cannot occur. Cage sites are thoroughly prepared before planting and are cultivated often during the growing period. When ripe the plants are harvested by hand, the seed from each being cleaned and packeted separately.

HEADING PHOTOGRAPH: Commercial seed crops are inspected periodically.

Before further multiplication is attempted the seed of each parent plant must be tested in the field. A portion of the seed from each transplant is sown out in a single row for bulb production in what are known as single-plant selection trials. By this means selections which show any defects, such as not breeding true to type, can be detected, and the balance of the seed which was used to sow that row is immediately discarded. In other words, only the best of the selections based on their performance in a progeny test are carried forward to the next stage.

Isolation Essential

The seed remaining from the retained selections is sown out in rows for further seed production. The seed is usually sown in a part of a field where the farmer is growing the same variety for a commercial seed crop, and care is taken to ensure that there is complete isolation from crops of other varieties. This precaution, it may be added, is taken not only with single plant selections, but is an essential factor at all stages of production. The reason of course is to prevent any crossing of the different varieties. The seed of each selection is sown separately, so that each row retains its original identity, and the rows are intercultivated and kept free of weeds. Any rows which show defects such as variations in flower colour are removed and not permitted to seed. Further, the seed from each row is harvested separately and included in field trials for further observation of bulb type, any bulbs not meeting the required standards being discarded. The seed of the retained units is increased in the following season by the same routine. After any further culling which may be necessary the remaining plots are harvested and



Upper—Any rows in the seeding blocks which show defects are removed. Middle—Rows are harvested and threshed by hand. Lower—The result of 5 years' work.

threshed together, the seed so obtained being referred to as nucleus seed.

Up to this stage nearly all the work has been done manually. Seed is sown either by hand or by small hand-pushed sowers. Crops are thinned where necessary and cultivated to remove weeds. Seed is harvested by hand because of the necessity of keeping the units separate. It is hand dressed roughly in the paddock and more thoroughly cleaned later on a midget dressing machine.

Commercial Multiplication

The nucleus seed is then passed on to the commercial grower for multiplication under supervision, the produce so obtained being known as stock seed. This stock seed is used to produce the commercial seed crop, or, if necessary, increased a further stage before being used for this purpose. But the work of the Department is not ended when the seed is passed on to the farmer, for the crops must be inspected periodically to detect and remove any trace of off-type plants if such crops are to be accepted for the production of Government approved seed. If any doubt exists as to the merit of the seed from any particular crop, it is held until tested in extensive field trials, on the results of which it will be either accepted or rejected.

Precautions against Mixing

Nor does supervision end after field observations are complete. Dressing machines are inspected before a different variety is dressed to ensure that no seed from the last line remains to become mixed with the next. Moreover, to eliminate any chance of mixing, in the buildings where Government approved seed is dressed and stored pending release to the retail trade no other brassica seed is handled or even stored. Supplies of seed of each variety which is to be distributed as Government approved for the growing of feed crops are obtained by blending sufficient seed from a number of lines of the particular variety to meet commercial requirements. Not only must the seed be of a quality acceptable to the Department, but the germination must also if possible be above a minimum requirement of 85 per cent.

Besides the testing of single-plant selections and odd doubtful seed crops in field trials, seed for commercial sowings is also tested to ensure that the standard of the variety is being maintained. Seed from overseas is also grown alongside New Zealand varieties for purposes of comparison and may be used to improve the present varieties or to introduce new strains or better varieties for particular districts.

Five-year Task

From the start with a few selected plants to the final stage of sufficient seed to sow the 400,000 acres of root crops required annually, the production of Government approved turnip and swede seed takes 5 years. All these steps must be repeated every year to ensure a constant supply of fresh seed to meet the farmers' requirements. This is one of those services to which the farmer gives little thought, yet which is so essential to the task of primary production and into which a great deal of time, thought, and endeavour has gone.

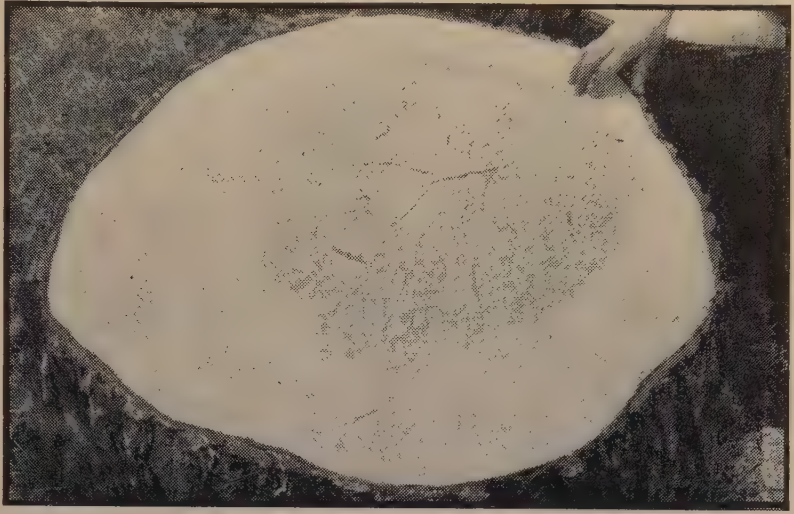
The Use of Timber in Farm Buildings

FOOD, shelter, and clothing are considered the basic necessities of human existence. Food and clothing can be considered as substantially consumable, whereas shelter can be considered as capital. In the long-term concept shelter is also consumable in that decay, depreciation, and obsolescence render what is adequate and efficient today inadequate and inefficient tomorrow. Farm shelter is indispensable, not only for human beings but also for the holding of crops, either for consumption on the farm or orderly marketing, and the raising and utilisation of animals in the production of food supplies. As timber is the most commonly used structural material, this article by H. W. T. Eggers, Engineer, and M. Sutherland, Farm Forestry Officer, Department of Agriculture, Wellington, has been written to help the farmer to get the most out of this material, thus ensuring the maximum resistance to depreciation and decay and the resultant longest life.

WOOD as a material for farm construction is versatile and economical. It comes in a wide variety of standard sizes, lengths, grades, and, until recently, species, and normally is easily purchased from neighbourhood sources. It is easily worked, is durable, has a pleasing appearance and "feel", and a structure built of wood is readily altered to meet changed conditions.

To use wood to the best advantage an understanding is necessary of how it grows, of the diversity in which it is obtainable, and the means by which it is selected for specific uses.

An intergrown knot.



The annular rings on this *Pinus radiata* stump show that the tree was 40 years old.

Growth of the Tree

A tree adds to its growth each year by the addition of a complete envelope of tissue, and these layers of annual growth appear as concentric rings in a cross section of the stem. The tissue of each annual ring varies throughout the growing season from large cells having thin walls (the spring wood) to small cells having thick walls (the summer wood). Spring wood is light in colour and summer wood dark. A young tree grows rapidly, adding wide rings each year. As it grows in height and girth the new annual tissue must cover a greater area and the rings become thinner. Thus very large, old trees show extremely narrow rings near the bark.

Sapwood is a layer of many annual growth rings forming the outer circumference of the tree under the bark. The thickness of the sapwood layer varies with the species; in some trees in New Zealand it is several inches thick. Sapwood cells are living cells and transport food and water between leaves and roots.

Heartwood is the portion of the tree inside the sapwood layer. Annual rings of heartwood were formerly rings of sapwood, but the cells have become filled with minerals and no longer play an active part in the life of the tree, except for support. Heartwood is darker than sapwood.

The illustration above shows a section through a tree with 40 years' growth indicated by annular rings; also shown is the difference in colour between heartwood and sapwood.

Each layer of annual growth covers the trunk and branches like a sheath. Young branches originate in the cambial layer of the inner tissue of the trunk, and each layer of annual growth covers the trunk and branches like a sheath. As long as the branch is a living part of the tree the annual growth rings over the branch are a continuation of those over the trunk and the branch at this time is "intergrown"; as the tree gains height and adds new branches at the top the older, lower branches die for lack of sun. Rings of annual growth grow to the dead branch but not over it as when it was alive. Eventually the branch breaks off and as successive layers of growth are added to the trunk the stub of the branch is finally submerged and covered. Additional layers formed beyond the end of the stub are all clean wood. Thus intergrown knots, encased knots, and clean wood are formed.

Strands of the thick-walled wood cells or fibres of most trees grow erect following the axis of the tree, but infrequently the fibres coil spirally around in the tree. Sometimes the spiral grows in one direction for part of the life of the tree, then straightens, and then leans backward to spiral in the other direction. The cause of such growth is unknown, but it is characteristic of certain species and has an effect on the quality of the timber.

An intergrown knot is shown in the illustration at left and twisted grain in the illustration on page 611.

Grading of Timber

All the growth characteristics described are considered when timber is graded. The relative thickness of the summer-wood portion of an annual ring is a gauge of strength because of its greater density.

Rate of growth is also a measure of strength, as wide rings of thin walled cells lack density. Sapwood is as strong as heartwood, but less durable. The size and location of knots are factors in structural and other grades. The character of the knots, whether tight (intergrown) or loose (encased), is considered for appearance as well as for general use. The sharper the slope of the grain, either spiral or diagonal, the weaker the piece.

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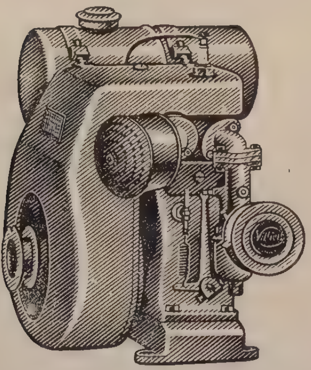

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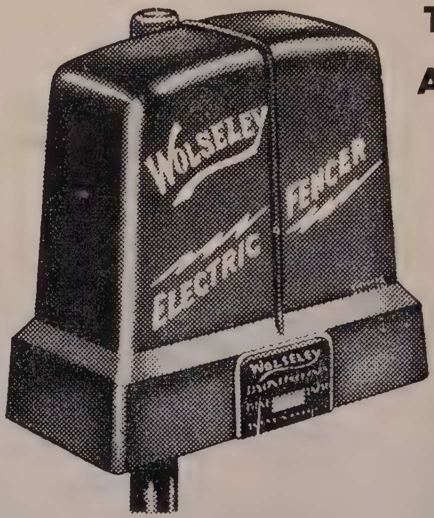

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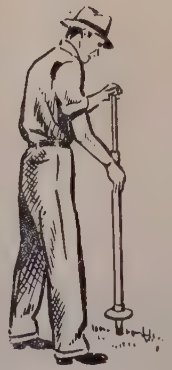

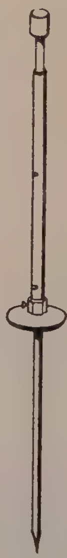

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Diagonal grain usually results when timber is cut straight from a tapering tree trunk.

National Grading Rules

For many years timber has been standardised in sizes commercially available to the average buyer and in 1938 a standard specification was issued for the grading of the common indigenous softwoods used for building. This specification, amended to cover insignis pine for both framing and finishing grades, has now become the National Grading Rules, under which virtually all timber produced in New Zealand is sold.

These rules set out the standards of:—

1. Measurements and tally.
2. Size classification.
3. Quality classification.
4. Grade classification.

They also give definitions of blemishes and defects on which the grade classification is based.

Adoption of these rules has benefited the producer, dealer, and consumer. Some extracts of the rules as contained in New Zealand Standard Specification No. 169 are as follows:—

1. **Measurements and tally:** The original green rough-sawn nominal size is used as the basis of measurement and tally. Timber 1in. and over in thickness must be tallied board measure, and timber of thickness less than 1in. must be tallied surface measure. The unit of board measure is a piece of timber 1ft. long by 12in. wide by 1in. thick or equivalent cubic content and is signified as "ft. B.M."

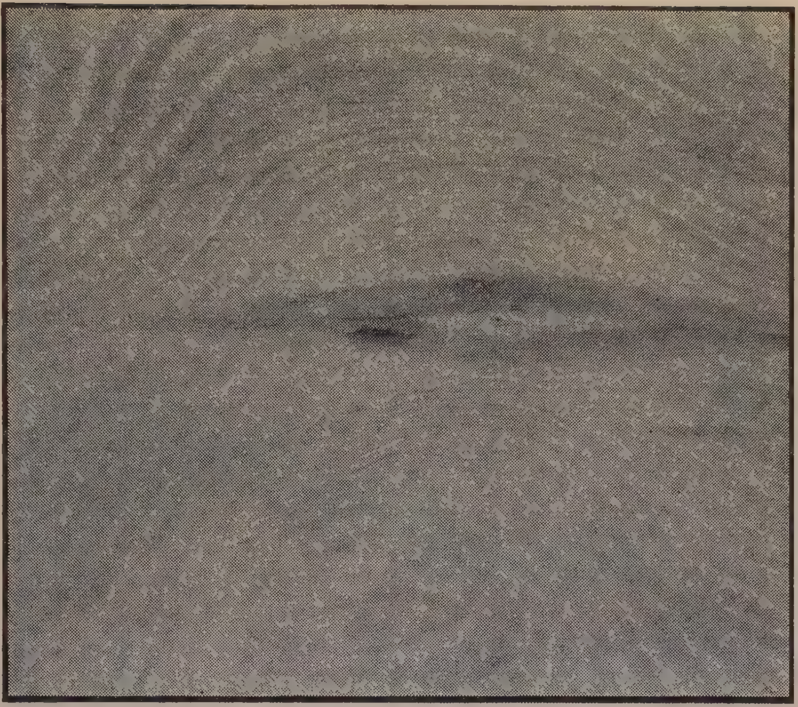
2. **Size classification:** "Battens" are timber less than 1¼in. thick and under 4in. wide. "Boards" are less than 1½in. thick by 4in. or over in width. "Scantlings" are light structural timbers from 1½in. thick and up to 6in. wide but not exceeding 12 sq. in. cross section. "Planks" and "joists" are timbers from 1½in. up to 4in. thick by 5in. or over in width. "Baulks" or "heavy timbers" are all sizes 3in. and over in thickness and 4in. or over in width, provided the cross sectional area exceeds 12 sq. in.

3. **Quality classification:** For marketing, building timbers are classified in two grades of quality—heart and ordinary. Timber classified as heart shall contain 100 per cent. heartwood, and standard qualities of timber classified as ordinary need not contain any heartwood. Where a demand exists for timber of intermediate quality the price lists must make provision therefore and name such qualities according to the percentage of heart required, for example, 50 per cent. heartwood or 75 per cent. heartwood.

4. **Trade classification:** Under this classification building timbers are classed in two groups of standard grades, one for framing and the other for finishing. The names of the grades are as follows:—

Framing grades	**Finishing grades**
Building A	Clears
Building B	Dressing A
Commons	Dressing B

Dressing B is produced incidental to the sawing of clears, and dressing A and building B are produced incidental to the sawing of building A. Commons is a cull grade.



Twisted grain affects the quality of the timber.

Pinus Grades

The grade classification of *Pinus*, which is somewhat different from that of the indigenous timbers, is as follows:—

Framing Grades

"No. 1 dimension", for use as bearing members.

"No. 2 dimension", for use as non-bearing members.

"Shop grade", for use as bearing and non-bearing members in limited lengths, shall consist of pieces each of which will yield at least one 8ft. length of No. 1 dimension or No. 2 dimension, the remainder of each piece being suitable for short cuttings.

"Boxing grade" is timber which does not conform to the requirements of any of the other grades named.

These grades are all subject to certain provisions regarding blemishes and defects the permissible extent of which is clearly defined for each grade.

Machining Grade

Machining grade is subdivided into finishing grade and dressing grade. Finishing grade is sound sawn timber intended for machining on four sides, and the boards must conform to certain requirements in respect of the better face; these requirements cover knots, surface checks, bow, crook, and cup. Dressing grade is sound sawn timber intended for machining on four sides into flooring and weatherboarding in widths up to and including 6in. As for finishing grades this grade must also conform to certain requirements covering knots, holes, resin and bark pockets, pith, wane, stain or discoloration, crook, bow, surface checks, and cup.

The grade into which timber cut from any particular log is placed is decided by the number and type of blemishes and defects apparent in each piece. The National Grading Rules set out in detail the number and type of blemishes and defects permitted in each grade and also closely define them. This permits a maximum uniformity of grading for a variable product such as timber.

Classes of Timber

From the early days of New Zealand's history the main sources of supply of building timber have been the readily available indigenous softwoods such as rimu, miro, matai, and totara, and in certain districts other timbers which are more prevalent, such as kauri in the north and beech in the south.

With the large amount of milling and the destruction of native forests to provide farm lands this supply of timber is rapidly becoming exhausted and resort must be had to the quick-growing exotic pines which have been planted on what would otherwise be waste land. Growth of large areas of these exotics has now reached the stage where by an organised system of cutting and replanting a continuous supply of timber is assured for future building needs, a supply that can be increased as native timbers become more scarce.

The use of pine for building must cause a complete change in building technique, as one timber only will be available for all parts of the structure and the choice of varieties best suited to particular applications cannot be made as is customary at present.

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Suitable Indigenous Timbers

The following is a list of indigenous timbers suitable for building, including varieties not normally available from commercial sources. These timbers have been included to enable the farmer who is felling his own timber and having it milled to determine which timbers are most suitable for various applications.

It must be remembered that the uses given for timbers are suitable provided only that the timber which it is proposed to use is of the correct recognised grade for the purpose required; for example, tanekaha timber should be used as alternative to rimu or matai only if the particular sample conforms to the accepted requirements of strength, hardness, ease of nailing, nail-holding power, and durability.

Subject to this condition the following list suggests general and particular uses for which the timbers in question are suitable:—

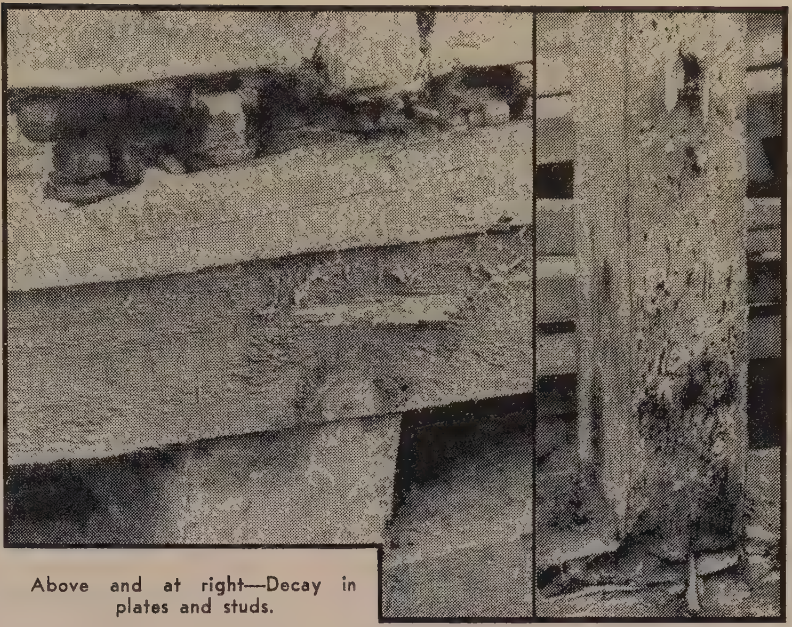
Kauri: "Mediums" and "seconds" (containing sapwood) are used when available for general uses in interior building and furniture, and the high qualities of the heartwood—straight-grained, strong, even-textured, and easily worked and finished—make it suitable among other uses for vats, churns, sink benches, and laundry appliances.

Rimu: For most above-ground and interior building construction; plywood and furniture.

Miro: Resembles rimu, for which it is often marketed; is stronger and harder, but more liable to warp if carelessly seasoned.

Matai: The hard and even-wearing properties of the heart timber make it the most suitable timber for flooring and also for desking and sills, and sapwood grades treated with preservative are used for weatherboard, plywood, and tallow casks.

Totara: The heart timber, being light, straight-grained, free from warping, easily worked, and exceptionally durable, is suitable for piles, exterior joinery, and construction; the pale brown sapwood is more durable than that of other indigenous softwoods and is suitable without preservative for many constructive uses where softness and brittleness are no objection; for fencing posts.



Above and at right—Decay in plates and studs.

A totara pile. Decay occurs in piles where the wood is exposed to both ground moisture and air.

Tawa: A hard, straight-grained, strong, but not shock-resistant timber, with excellent finishing qualities; is suitable for interior woodwork and flooring, furniture, and turned products; it should be kiln dried green and treated to give immunity from powder post borer attack.

Kahikatea: Its odourless character formerly made it exclusively suitable for dairy produce containers, but it is now available for use in miscellaneous woodware, vats, cheese crates, furniture, and (with preservative treatment) in house building. Natural heartwood of the hill-grown "yellow pine" type is durable and a useful substitute for heart kauri.

Tanekaha is an alternative to rimu and matai for building and to Douglas fir for haymasts, hayrakes, and battens.

Silver pine: A straight-grained, easily worked, and very durable timber used in cabinet work and for fencing posts and poles.

Southland beech: Strong, easily worked, not durable; can be used for flooring and interior finish, agricultural implements, tool handles, dowels, barrels, cheese crates, and furniture.

Black beech: The heartwood is very durable and suitable for fencing timber and bridging; the sapwood for dowels, handles, and in some grades for building timber. It rapidly blunts the saw on account of silica content.

Red beech: An even-wearing timber which when well seasoned can be used in house construction for flooring, for furniture and fencing, and as bridge timber.

Mountain beech: Used as a substitute for silver beech and as a tough, straight-grained, even-textured timber for flooring and general building, or gates, trucks, and implements.

Mangeao: A tough and strong timber useful for tools, coach finish, and wheelwright's work.

Kohekohe: Useful for furniture and interior finish.

Rewarewa: Heavy and strong and can be used for rails, blocks, swingle trees, tool handles, and interior furnishing.

Pukatea: Though light, the timber is strong and tough and can be used for roof boards, weatherboarding (if preservative treated), and battens.

Kaikawaka: A light timber of poor strength and difficult to burn, it is suitable for interior finish and fireproof items and is also fairly durable for use as poles and posts.

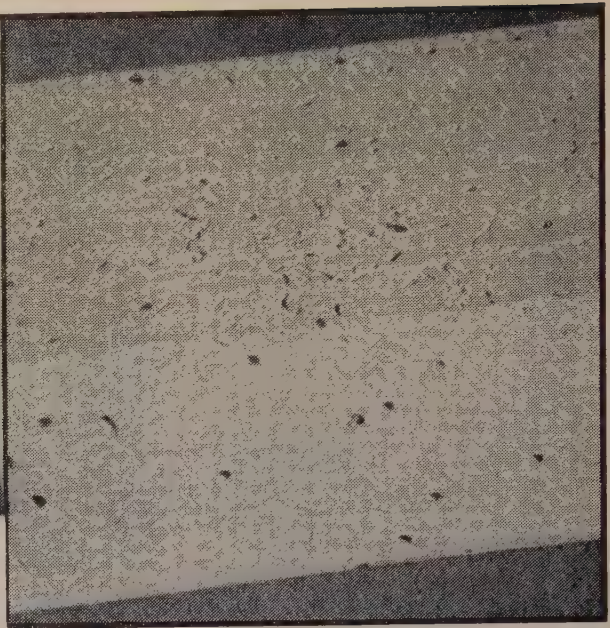
Timber Decay

Timber, unlike other more permanent structural materials, is subject to decay and attack by insect pests and fungi. This is due to the fact that it is formed of vegetable cells and fibres produced by active chemical action during growth. Once this chemical action is stopped and the cells and fibres become dead the natural resistance to decay possessed by the living substance ceases with consequent increased susceptibility.

With any living substance the effect of age is to decrease the natural resistance to decay and disease and this applies equally to trees.

The rate of decay of timber depends on a number of physical factors related to the class of timber, climatic conditions, prevalence of wood-boring insects, and the subjection of the wood to moisture and temperature. These factors can be offset by choice of timber and techniques of treatment that will reduce the rate of decay to a minimum and so ensure reasonably long life for timbers used for structural purposes.

Decay is directly related to the moisture content of timber, for which



Above—Decay in weatherboarding. Right—Destruction caused by insects.

"fibre saturation" is the prime measuring point. Fibre saturation is explained as the moisture content above which there is free water in the cell cavities and below which the remaining moisture is in the wood substance. It is an important moisture content level, because decay will not live at less than fibre saturation and shrinkage begins at this point.

Timber decay is produced by fungi which beside needing air for their life thrive on the wood substance rendered palatable by moisture. If moisture is so excluded that the moisture content is lower than fibre saturation, decay will be prevented; conversely if moisture is included but air excluded, decay will again be prevented, because the fungi cannot thrive without air. An example of this can be found in totara piles used in building. They remain sound in the ground excluded from the air but subject to ground moisture, and sound above ground where exposed to air but dry; decay takes place in that area where the timber is exposed to both ground moisture and air as shown in the illustration on page 613.

Where a choice of class of timber exists the timber with characteristics best suited to any particular application can be used; that is, the class offering most resistance to applicable conditions of decay while also fulfilling the requirements of loading and service. Resistance to other applicable factors of decay not normally possessed by the species can be given by suitable protective treatment with paint, preservatives, and insect-repellent preparations. For example, totara and puriri are used for building piles, as both offer high resistance to softening induced by ground moisture where air is excluded; that is, the requirements of loading remain unimpaired. Matai is used for weatherboarding, but, being subject to deterioration and decay when exposed alternatively to sun and rain, should be protected by a coat of paint.

When the choice of timber ceases as different species become scarce it will be necessary to rely more and more on protective and preservative treatment to provide the decay and insect resistant qualities not normally possessed by the species available. The difference in the relative strengths of the various species to meet the requirements of loading is not such an important factor, as within economical bounds strength can be increased by increasing sectional area.

Appearance may be a factor affecting choice for finishing grades, but as the modern tendency is toward enamelled finishes, the use of one timber for all building may not be such a disadvantage.

Methods of construction have an important bearing on the susceptibility of timber to decay and any departure from accepted practices can produce points of weakness in a structure where decay is accelerated.

Decay in weatherboarding and destruction due to insects are shown in the illustrations above.

Wood Protection and Preservation

As timber decay is produced by exposure of timber to moisture and air and the ravages of insects, protection can be given by treatment to

1. Exclude moisture.
2. Exclude air.
3. Repel insects.

The first can be accomplished by painting the timber with an oil base paint. The oil serves a double purpose, being the vehicle conveying the waterproof skin-forming materials (usually oxides) while also acting as a waterproof preservative penetrating the outer cells of the timber. Painting also excludes air.

The second treatment, exclusion of air, is limited in application, as though the presence of air permits timber-decaying fungi to live, it also tends to kill them by denying them the food rendered palatable by moisture. A free circulation of air will dry out moisture and so prevent decay.

The objects of the first two treatments can also be achieved by the method applicable to treatment 3; that is, by the use of preservatives which, injected into the timber, poison the wood substance on which the decay-producing fungi or wood-boring insects thrive.

There are several methods of applying preservatives to timber and a large number of substances which are used to give preservative protection.

The method of application will depend on the preservative, the type of timber, and the use to which it will be put. For the preservation of such timbers as poles or railway sleepers complete penetration of preservative is not essential and is also physically and economically unreasonable, but for house-building timbers which are liable to extensive cutting and shaping after treatment complete impregnation is necessary.

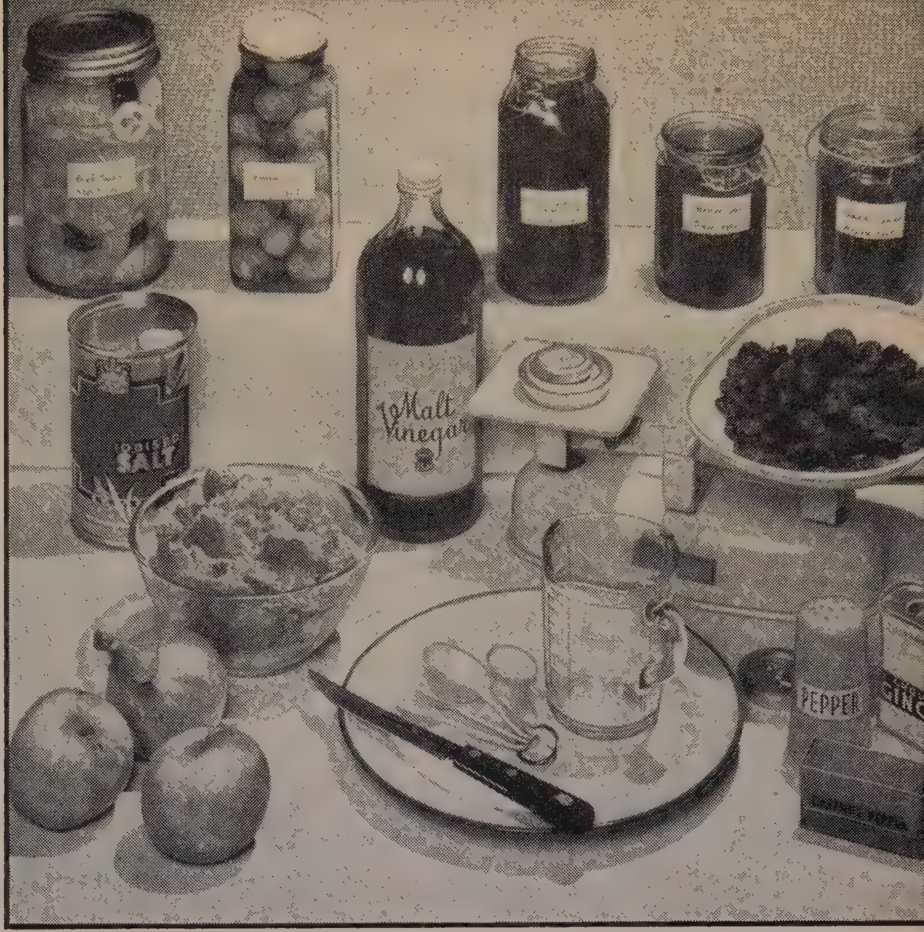
If timber is not to be cut and shaped after treatment with preservative, protection may be applied in the form of a preservatised outside skin completely enclosing the inner, untreated timber. Naturally timber treated in this manner must be free from the possibility of cracking due to temperature and humidity changes, as any break in the protective layer will provide access for moisture, air, and insects.

The New Zealand Standards Institute has issued a recommended "Code of Practice for Timber Preservation" which covers methods of applying preservatives and the substances which can be used. Tables are given indicating the best type of preservative and method of application for timber for varying purposes.

Timber used for farm structures which has received protective preservation treatment in accordance with this code of practice will give long service without decay or ravages by insects provided normal maintenance as recommended is also carried out.

Preserving the Year Round

By EVELYN E. MOORE, Field Officer in Rural Sociology, Department of Agriculture, Palmerston North



Bottled at the back are preserves which are made from ingredients shown on page 617.

WELL-FILLED shelves of home-made preserves, bottled fruits and vegetables, jams, pickles, and sauces are a source of pride and pleasure to every housewife who has worked to preserve the surplus fruits of summer for her family's enjoyment in later months.

HOWEVER, the mild winter climate enjoyed by some parts of New Zealand provides it share of the year's fruits and vegetables also, and these, when there is a surplus in the home orchard or when market prices are relatively low, can also be utilised. In addition winter fruits have a higher nutritive value than some popular summer fruits for preserving. Pears, plums, and peaches, for example, have a low vitamin C content compared with such winter fruits as tree tomatoes, Chinese gooseberries, and grapefruit, the juice of which can easily be preserved.

Sometimes, too, when the stores of jams, pickles, or sauces become low it is surprising how many of the foods easily available during winter and spring can be utilised to make delicious home-made preserves.

In this article, therefore, instructions for bottling fruits which mature during late autumn, winter, and spring are given, together with a variety of recipes for pickles, chutneys, and jams which may be made during winter, or, in fact, at almost any time of year.

Bottling Fruits

The majority of sub-tropical fruits and vegetables ripening or maturing during the winter bottle well and retain their flavour. Probably the best known of these are tree tomatoes and Chinese gooseberries, popular North Island fruits, which are gradually becoming better known and more popular in southern areas. Other winter fruits which are easily bottled are feijoas and passion fruit, including banana passion fruit which is a good substitute for the other passion fruit in fruit salads. Bananas and oranges may also be included in the list for the housewife who likes to have a small emergency supply of fruit salad fruits on her shelves. Figs, although more difficult to bottle, are delicacies the housewife with a fig tree which bears plentifully might like to try. Rhubarb should not be forgotten, for, although the family may become tired of it if it is served too frequently during the height of its season, bottling the surplus crop when it is at its best will provide a welcome variety in later months and also avoid the need to serve it too frequently so that it will not be wasted.

Recipes

In previous articles in the "New Zealand Journal of Agriculture" methods have been described of bottling Chinese gooseberries (March 1950), feijoas (April 1952), passion fruit (March 1952), and tree tomatoes (September 1947).

However, the methods of bottling generally may also be used for these fruits, and any of the three methods—pre-cooking, water bath, or the oven—may be used. The table on page 617 gives details of processing times and methods of preparation.

Bananas

Bananas brown quickly after being peeled and sliced, unless sprinkled with lemon juice. Peel, slice in halves lengthwise, and pack quickly in jars, sprinkling with lemon juice to prevent browning. Pour over hot syrup and process in a boiling water bath for 30 minutes.

Figs (Fresh)

Figs should be well ripened but firm, and because they have a low acid content, special care, as in bottling vegetables, is required for success. Wash them, place in hot water, bring to the boil, remove from the heat, and stand for 3 minutes. Drain and pack hot into hot jars. Add 1 tablespoon of lemon juice to each quart jar and pour in boiling syrup (½lb. of sugar to each 2 cups of water) according to instructions with the type of jar used, adjust lids, and sterilise by boiling in a water bath for 1¼ hours. For additional flavour a small piece of ginger root may be added to each jar.

Oranges

Oranges, like bananas, may, if desired, be bottled for emergency use, for fruit salad for example. It is best to choose very sweet oranges and carefully remove all white pith and skin, as this tends to make the bottled fruit bitter. The best flavour is obtained by bottling in orange juice, but this is not necessary, and a light syrup (¼lb. of sugar to 2 cups of water) may be used instead. Sterilise in a boiling water bath for 20 minutes.

Rhubarb

The only preparation choice rhubarb needs for bottling is wiping with a damp cloth. As it is a soft fruit which breaks very easily, it is best bottled by the water bath method. It may be packed in sticks cut to fit the length of the jar or cut in cubes ready for use before packing. The former method, though easier for packing, is not so convenient later, as the long stalks need cutting before serving, and are apt to break and lose their attractive appearance. The flavour of bottled rhubarb is improved by preparing a syrup (½lb. of sugar to 2 cups of water), adding the rhubarb, and soaking it overnight before packing and processing. This method, because

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TENNIS BISCUITS

6 ozs. butter
2½ ozs. icing sugar
6 ozs. flour
2 ozs. EDMONDS Cornflour
½ teaspoon vanilla essence
1 tablespoon each of — cherries, angelica, peel and almonds chopped finely and mixed together.

Method:
Cream butter, sugar and vanilla, then add remainder of ingredients. Roll in small balls. Flatten and place a piece of cherry on each. Bake 15-20 minutes, 350° F.

CHOCOLATE SULTANA CAKES

4 ozs. butter
2 eggs
1 tablespoon cocoa
4 ozs. sugar
4 ozs. flour
2 ozs. sultanas
few drops of vanilla
2 ozs. EDMONDS Cornflour
1 tablespoon milk
1 teaspoon EDMONDS Baking Powder

Method:
Cream butter, sugar and vanilla. Beat eggs and add alternately with sifted dry ingredients. Lastly, add milk. Bake in greased patty tins 15 minutes, 400° F. When cold, ice with chocolate butter icing.

COBURG CAKES

4 ozs. butter
3 ozs. sugar
2 teaspoons golden syrup
2 eggs
1 tablespoon milk
4 ozs. flour
2 ozs. EDMONDS Cornflour
½ teaspoon soda
½ teaspoon nutmeg
1 teaspoon ground ginger
pinch of spice

Method:
Cream butter, sugar and golden syrup together. Beat eggs well, add milk and mix in alternately with the sifted dry ingredients. Bake in paper cases for 15 minutes, 400° F. When cold, remove tops and fill with whipped cream. Replace tops and dust with icing sugar.

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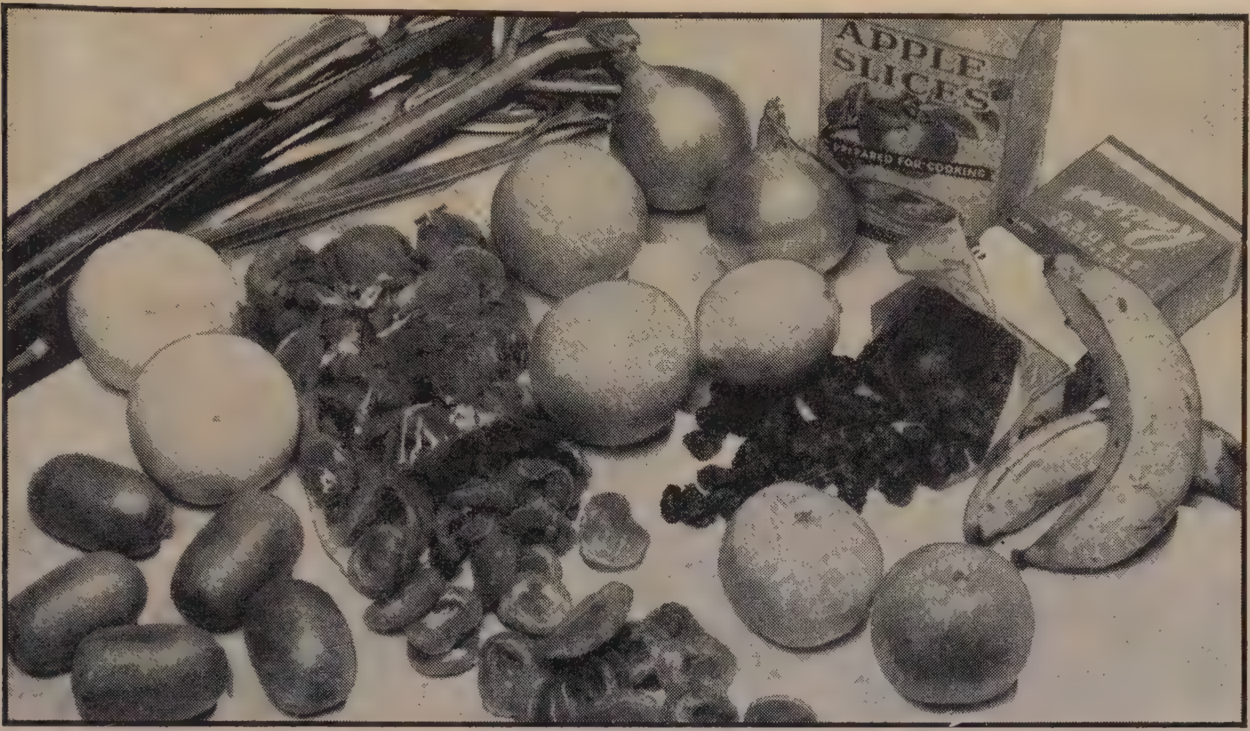


Ingredients for preserves which may be obtained and used at almost any time of the year.

of shrinkage, allows more rhubarb to be packed into a jar. The use of a syrup containing equal quantities of sugar and honey (¼lb. of sugar and ¼lb. of honey) is also considered by some to improve its flavour.

Citrus Fruit Juices

Though it is easy to preserve citrus fruit juices so that they will keep, flavour is apt to be impaired if the juice is boiled or heated too much. The following recipe helps guard against this fault.

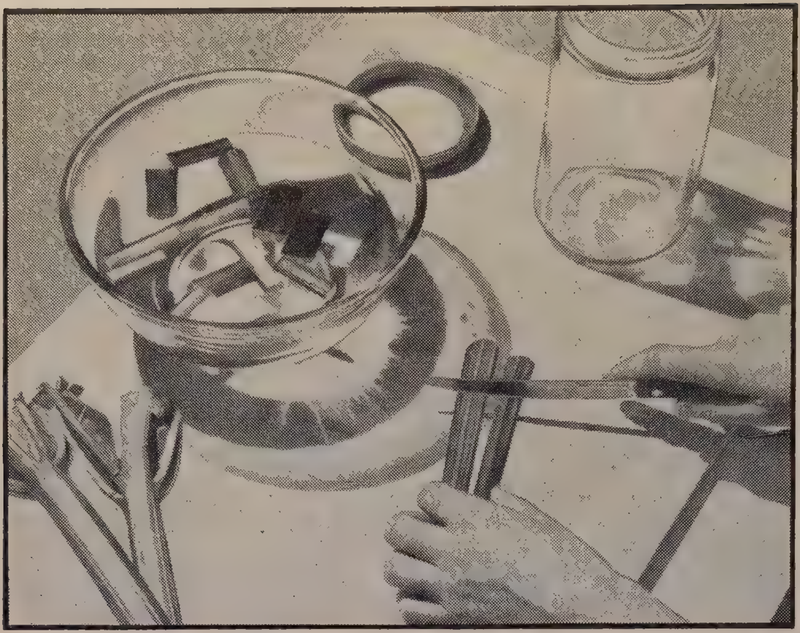
Squeeze the juice into a glass, enamel, or earthenware bowl, as some metal bowls tend to give the juice an unpleasant flavour when it has been left standing in them. Strain the juice, if desired, add sugar to taste, and pour into clean bottles or preserving jars. Preserving jars should be sealed according to the instructions given and corks tied loosely into bottles so that air may escape.

The jars and bottles are sterilised in a covered water bath, beginning with cold or warm water. Heat until the water temperature is 180 degrees F. (It is important not to boil the water in the water bath.) Sterilise the juice at this temperature for 25 minutes.

Bottles or jars are then removed and jars treated according to the instructions given with the type of seal used. Corks are pushed tightly into bottles and tied securely in place with fine strong string. When the bottles have cooled somewhat corks are sealed by dipping in molten paraffin wax so that it comes well over the string and lip of the bottle. For safety, corks may be dipped a second time in melted paraffin, which should completely cover the first coat.

Processing Times and Methods of Preparation of Fruit for Bottling

Produce	Preparation	Processing Methods and Times
Bananas	Peel, slice lengthwise, or crosswise, sprinkle with lemon juice, and pack immediately. Use a medium syrup (½lb. of sugar, 2 cups of water).	Water bath method. Process 30 minutes in boiling water.
Chinese gooseberries ("Journal", March 1950)	Peel and leave whole or cut in halves either lengthwise or crosswise for packing. Use a medium syrup.	Any satisfactory method can be used successfully. Boil gently in syrup for 15 minutes and pack in sterilised jars (pre-cooked method) or process for 20 minutes in a boiling water bath.
Feijoas ("Journal", April 1952)	Peel, halve or quarter, use salt water (1 teaspoon to a pint) to prevent browning, blot dry with a clean cloth, and pack. Use a medium syrup.	Any satisfactory processing method can be used successfully. (Boiling water bath method, 20 minutes.)
Oranges	Peel, quarter or section, and pack. Use orange juice or a light syrup (½lb. sugar, 3 cups of water).	Boiling water bath method (20 minutes gives the best flavour).
Passion fruit (all types) ("Journal", March 1952)	Mix pulp with equal quantities of heavy syrup (½lb. sugar, 1 cup of water).	Boil pulp and syrup for 10 minutes. Pour into sterilised jars and seal.
Rhubarb	Wipe, cut up, and pack in jars. Use a medium syrup (½lb. of sugar, 2 cups of water). A honey syrup gives a pleasant flavour.	Boiling water bath method (30 minutes).
Tree tomatoes	Blanch, peel, and pack whole or halved. Use a medium syrup.	Any satisfactory method can be used successfully. Boiling water bath method (25 minutes).
Citrus fruit juices	Squeeze, strain if desired, add sugar to taste, and pour into clean bottles.	25 minutes at 180 degrees F.
Figs	Wash. Use a medium syrup.	Bring to boil, stand 3 minutes. Drain, pack immediately in hot jars. Add 1 tablespoon of lemon juice to each quart jar. Add boiling syrup and process in boiling water bath for 1¼ hours.



Rhubarb being prepared for bottling.

Special Instructions

Grapefruit Juice

Add 3 to 6 tablespoons of sugar to every cup of grapefruit juice.

Orange Juice

Grate the rind of 12 oranges and 3 lemons. Pour 3 cups of boiling water over the rind and boil it for 15 minutes. Strain and add 1½ to 2 cups of sugar and stir until the sugar is dissolved. Add the fruit juice, pour into clean bottles, and sterilise.

Lemon Juice

Add 6 cups of sugar or honey to 4 cups of juice. Heat over hot water and stir until the sugar is dissolved. If the heating is being done over direct heat, be careful not to boil the juice. Strain and pour into clean bottles. Sterilise for 20 minutes at 180 degrees F.

Jam Recipes

Dried-fruit jams are useful both for eking out the supply of home-made jam and for providing additional variety, and, especially where fresh or tinned fruits have been added, their flavour is also the equal of fresh-fruit jam.

Dried Apricot, Pineapple, and Orange Jam

1lb. of dried apricots
1½ pints of water
3oz. of blanched almonds
1 small tin of crushed pineapple
1 tablespoon of lemon juice
1lb. of oranges, peeled and cut in thin slices

Rinse the fruit and soak it for 24 to 48 hours in the water. Place the apricots, the water they were soaked in, and sliced oranges in a pan and boil gently for 30 or 40 minutes, stirring occasionally. Add the pineapple, measure the ingredients, and add an equal quantity, cup for cup, of sugar.

Boil rapidly and stir to prevent the jam from burning, until it gives the setting test. Pour into hot sterilised jars and cover.

Dried Apricot Jam

1lb. of dried apricots
2½lb. of sugar
3 pints of water
2oz. of blanched almonds
Juice of 2 lemons

Rinse the fruit and soak it for at least 24 hours in the water. Place the apricots, the water they were soaked in, and the lemon juice in a pan and boil gently for 30 minutes, stirring occasionally to prevent burning. Add the sugar and cut up almonds and boil briskly, stirring to prevent burning, until the jam sets when tested. Pour into hot sterilised jars and cover.

Cape Gooseberry Jam

2lb. of Cape gooseberries
2¼lb. of sugar
¾ cup of water
Juice of 1 lemon

Simmer the fruit, lemon juice, and water for 15 minutes. Add the sugar, bring to the boil, and boil rapidly until it will set when tested. If the jam is allowed to cool slightly before it is poured into the jars, a more even distribution of fruit in the jar will result. Cover.

Rhubarb and Ginger Jam

4lb. of rhubarb, wiped and cut up
3lb. of sugar
2 teaspoons of citric acid
2 teaspoons of ground ginger or 6oz. of chopped preserved ginger

Place the rhubarb and sugar in layers in a bowl and leave it to stand overnight. Put the contents of the bowl in a pan, add the acid and ginger, bring to the boil, and boil briskly until the jam jells when tested. Pour into jars and cover.

Bulletins for Housekeeper

Nos. **Free Bulletins**

335 Cooking with Compressed Yeast.
350 Tomato Cookery.

Nos. **Chargeable Bulletins**

337 The Child and His Family. 6d.
338 Food and Health. 1s. 6d.

The above bulletins are available post free from the nearest office of the Department of Agriculture, or from the Head Office of the Department, Box 2298, Wellington.

Rhubarb and Fig Jam

4lb. of rhubarb, wiped and cut up
1lb. of dried figs
3 pints of water
6lb. of sugar
8 tablespoons of lemon juice and 4 lemons (rind and pith) or 2 teaspoons of citric or tartaric acid

Soak figs and acid overnight in 2½ pints of water. Add rhubarb and lemon juice, rind, and pith and boil gently until the fruit is cooked and tender. Add sugar and boil briskly until the jam will set when tested. Pour into jars and cover.

Pickles and Chutneys

Dried Fruit Chutney

½lb. of dried apples
½lb. of dried peaches
½lb. of dried apricots
½lb. of stoned dates
½lb. of seedless raisins
½lb. of onions or garlic
1lb. of sugar
1 tablespoon of mixed spices
1 tablespoon of salt
½ teaspoon of cayenne pepper
2 cups of vinegar

Soak the dried fruit overnight in water, drain, and cut it in pieces, and stew it in some of the soaking water until it is soft. Mince the dates and raisins, chop the onions or garlic, and add with the other ingredients to the fruit and cook for ½ hour longer, when the chutney should be thick and soft. Stir frequently, as the mixture is apt to stick to the bottom of the pan and burn. Bottle hot and cover lightly.

Lemon Chutney

1lb. of lemons
1lb of onions
1lb. of sugar
4oz. of raisins
4oz. of sultanas
1 dozen chillies
2oz. of salt
1½ pints of vinegar

Squeeze the juice from the lemons, remove the pips, and mince the peel and pulp. Chop the onions and dried fruit and cut the chillies in tiny pieces. Mix all together and leave for a few hours. Simmer till thick, bottle hot, cover tightly, and keep a month before using.

Rhubarb Chutney

5lb. of rhubarb
1lb. of onions
2lb. of sugar
½oz. of ground ginger
½oz. of salt
¼ to ½oz. of curry powder
1½ pints of vinegar

Cut up the rhubarb, mince the onions, add the spice, sugar, salt, and ½ pint of vinegar, and cook slowly until the rhubarb is tender. Add the remaining vinegar and simmer gently until it thickens. Keep well stirred during cooking.

Bottle hot and cover tightly.

Storage of Furniture Polishing Cloths

FURNITURE polishes may contain turpentine or benzene, both of which are highly inflammable. Cloths used for applying polish may be washed out immediately after use, or better still soft rags or cotton-waste may be used for applying the polish and burnt as soon as they are finished with.

If polishing cloths must be kept (as when a duster sprinkled with furniture polish is kept for daily dusting), they should be stored in a tin with a well-fitting lid or in a covered earthenware crock.

—*MAUD B. STRAIN,*
Field Officer in Rural Sociology,
Department of Agriculture,
Dunedin

Spring-flowering Shrubs in the Flower Garden

SPRING brings a wealth of colour and beauty to the whole countryside. Hedges and trees break into growth, and fruit trees blossom to provide an admirable background for the garden; and though effects differ from district to district and from garden to garden, there can be few places where there is not some shrub adding to the seasonal display. In this article M. Joanna Lockie, Horticultural Instructor, Department of Agriculture, Auckland, discusses some spring-flowering shrubs.

[Douglas Elliott

Kerria japonica is a deciduous shrub with light foliage, fine green stems, and twiggy growth which makes a dainty addition to a shrub border.

FEW gardeners should have difficulty in providing a brilliant display of flowers during spring. This can be the most colourful time of the year and the range of shrubs flowering at this season is wide and varied. Shrubs can be selected for colour, scent, size, and shape.

There is a solidarity about shrubs which is lacking with annuals, bulbs, and perennials, though each makes an effective contribution toward a colourful garden, particularly where spring-flowering bulbs are grown in conjunction with shrubs.

Because shrubs are permanent and form the mainstay of the flower garden, they are often inclined to be taken for granted and neglected, sometimes unintentionally. Pruning, even if it is only the removal of dead wood, and mulching, manuring, and staking where necessary, make possible better results.

Selection of Shrubs

Whether shrubs are being chosen for a new garden or are being added to the collection care is necessary. The selected shrub should be one which can be expected to thrive under the conditions of the district. Though advantage may be taken of shelter and shade and of sunny corners, prevailing local conditions have a definite bearing on the choice.

Frost-tender subjects are seldom wholly satisfactory in areas subject to frost, though in isolated gardens, where favourable conditions have been created, there may be a frost-tender shrub growing to perfection. Plants which require a cool moist soil throughout the year cannot be expected to grow in districts subject to summer drought. But that does not mean that such gardens cannot have an equally good or even better display, though the shrubs used to create the effects are totally different. Coastal gardens are another group which must be planted with material suitable for the conditions.

The most ordinary shrub, grown under conditions which suit it, always looks healthy and vigorous and because it is obviously doing well, gives greater pleasure and satisfaction than a rare or choice specimen struggling under adverse conditions.

Shrubs for Average Conditions

The shrubs given will grow readily under average garden conditions. Most of them can be increased fairly easily either by cuttings or division and their flowers are useful for cutting as well as for garden display.

Flowering currant (*Ribes sanguineum*) grows rapidly to form a neat shrub up to 6ft. high. The soft green, ribbed foliage is deciduous and the deep pink flowers are borne in numerous pendulous clusters. Easily increased from hardwood cuttings taken before the leaves appear, this shrub makes a most satisfactory ornamental hedge and even a single bush of it is excellent for stopping draughts around the house.

The fuchsia flowered gooseberry (*Ribes speciosum*) is equally useful as an ornamental hedge or specimen plant, though it is not so well known. The bright shiny green foliage is borne along the tops of the branches, and the dark red flowers are suspended beneath them, giving a fuchsia like effect. The shrub is easily increased by hardwood cuttings and is an excellent hardy ornamental.

Mexican orange (*Choisya ternata*) is another shrub which can be used as an ornamental hedge or as a single specimen. As a hedge it requires little trimming. Its foliage is dark green and glossy throughout the year. In early spring the scented white flowers, which last up to 2 months, are borne profusely and show up well against the foliage. Up to 6ft. high, it is inclined to spread a little and should be allowed at least 4ft. in which to expand. It stands coastal conditions and can be struck from hardwood cuttings in winter.

Deutzia scabra (Pride of Rochester) bears sprays of fine petalled, double flowers which are white tinged pink. It grows to a height of 4ft. and flowers best if rarely pruned. It prefers a well-drained though moist situation which does not dry out too much in summer. There are several varieties, all of which can easily be increased from hardwood cuttings.

Weigelias, often known as diervillas, provide many useful spring flowering shrubs. *Weigelia florida*, formerly grouped with diervilla, bears clusters of deep pink, tubular flowers along arching growths of the previous year. If pruning is carried out every year after flowering, the shrub can be kept to a branching bush of about 6ft. Left unpruned, it will grow to 12ft. or more and forms a tall slender shrub which may not have as many flowers but is just as effective. *Weigelia florida*

[*Douglas Elliott*

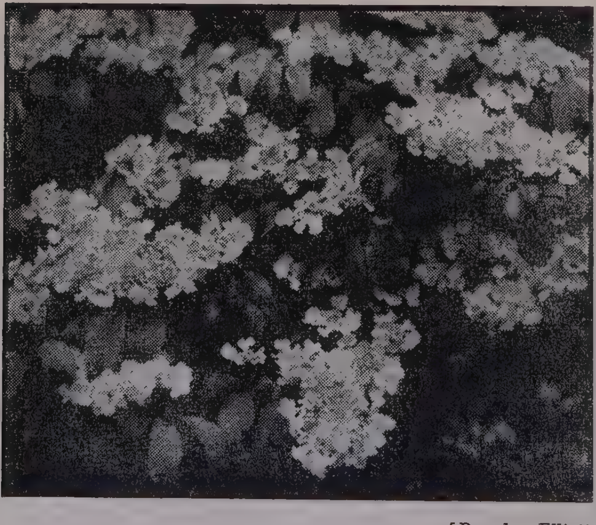
Viburnum carlesi, a favourite because of its scented flowers.

variegata forms a more compact bush, which grows to 5ft., and has most attractive silvery white patterned foliage and smaller pink tubular flowers. *Weigelia floribunda eva rathke*, height 4ft., is a compact shrub with tubular dark red flowers. It is most useful in front of a border. All these weigelias can be readily raised from hardwood cuttings during winter.

Kerria japonica with single yellow flowers and the variety *flore pleno* with double yellow flowers are two deciduous shrubs with light foliage, fine green stems, and twiggy growth which make a dainty addition to a shrub border. They are too light for a hedge or a specimen shrub, but with the bulk and mass of other shrubs around them kerrias can be most effective. Hardwood cuttings may be taken in winter or divisions made by the pulling away of rooted pieces and the planting out of these in winter.

Mock orange (*Philadelphus coronarius*) has a delightful fragrance reminiscent of orange blossom, and is well worth growing for its scent alone. There are several horticultural varieties of mock orange ranging from 8ft. to 12ft. high, with slight variations in the white or cream flowers. The shrubs grow readily even on poor soils and are best used as a background for herbaceous plants or in a mixed shrub border. Pruning consists of cutting out the old wood. Hardwood cuttings may be rooted during May, June, or July.

Guelder rose or snowball (*Viburnum opulus sterile*) is well known for its large balls of flowers, which as they expand, slowly turn from pale green to white and last well on the bush. The large maple-shaped leaves turn red and purple in autumn before they fall. The shrub grows to 12ft. to 14ft. to form a large dense shrub. Pruning should consist of cutting out all weak and spindly growth.



[*Douglas Elliott*

Viburnum tomentosum plicatum bears a profusion of white flowers in spring.

Viburnum burkwoodi and *V. carlesi* are not nearly as showy as the first viburnum, but they are possibly even greater favourites because of their scented white flowers. Flower clusters are produced freely on bare twiggy growth very early in spring. Both shrubs grow to 5ft. and with age form large dense bushes. They may be increased by hardwood cuttings taken in winter.

Pearl bush (*Exochorda racemosa*) forms a most graceful symmetrical shrub of 8ft. to 10ft. All its growth is light and twiggy so that even while it is leafless in winter it is still a dainty shrub. The wide-open white flowers of about 1in. across are borne profusely; the shrub is covered in flowers and as the flowers fade the soft green foliage replaces them. In some instances, a few seedlings may grow under the shrub, and they can be transplanted; otherwise it is not an easy shrub for the home gardener to propagate.

Lilac (*Syringa vulgaris*) has many horticultural varieties today, all of them worthy of garden space. Their colours range from white through shades of lavender and mauve to deep rose, and their scent is one of the joys of spring. Lilacs are inclined to sucker from the roots, and where this occurs the number of suckers should be kept down; otherwise much growth is produced which bears very few flowers. New bushes can be started from suckers, or can be grafted on to privet. Where there is a privet hedge which is no longer required certain plants may be retained and grafted over to lilacs, as privet is a suitable rootstock. Suckers are not likely to arise from lilacs worked on to privet, but where they do they should be destroyed. Pruning to shape is all that is required, though on young bushes it is preferable to remove the spent flower heads to prevent the setting of seeds.

Chinese lanterns (*Abutilon hybridum*) grow very easily from cuttings, and though inclined to be frost tender, they may often be induced to grow under the protection of taller shrubs and trees. Abutilons may be had in several varieties, with colours ranging through yellow and orange to red. The flowers, being large and usually of a harsh colour, show up well in the distance and last well on the bush. As their growth is inclined to be straggly, they should be shortened back each year after flowering to maintain a compact bush. *A. megapotamicum* is quite different in growth habit, foliage, and flowers. It is more spreading, with darker, narrow foliage, and the flowers are only about a quarter the size of the others, but are borne profusely for about 10 months of the year. From a distance when the yellow-petalled flowers protruding from dark red calyces hang from beneath the branches this shrub may give the impression of a fuchsia.

Cantua buxifolia requires a warm position and grows to a height of 6ft. Its leaves are small and insignificant and its growth habit is rather straggly, but all this is forgotten when the pendulous trumpet-shaped flowers are out. The flowers are an unusual deep glowing pink and the buds are quite colourful before they open fully, but because of the shrub's ungainly habit it needs to be grown where other shrubs will divert attention from it while it is not flowering.

Ceanothus is a group of shrubs outstanding for the intense blue of the flowers. Blue is a favourite flower colour with many gardeners. Though blue-flowered plants are often difficult to find, ceanothus can be used in an all-blue border, or in a border restricted to blue and white flowers only. It contrasts admirably with pink cherries and rhododendrons, or the yellow, flame, and orange of *Azalea mollis*. *C. papillosus roweanus*, the most brilliant ceanothus of all, grows to about 5ft. and can be used successfully in a mixed planting. Pruning of the small-leaved ceanothus should be done after flowering. The ceanothus with larger leaves and different habits is Gloire de Versailles, which grows to a height of 6ft. and bears terminal spikes of pale blue flowers. (In cold areas they may need protection from frost.) Marie Simon grows only to 4ft. and bears similar flower clusters of soft pink. These two have larger leaves, are semi-deciduous, and are pruned for shape just before spring growth begins.

Prostanthera, Australian mint bush, is well known in its many varieties and is much used. The leaf shapes and flower colours of prostantheras vary, but all of them require similar treatment. From the time of planting out they need training to develop a compact bush capable of carrying flowers from the ground up. While the bush is small the terminal branches can be nipped out several times to cause branching, and then every year after flowering at least 2-thirds of all the flowered material should be cut off. Once a prostanthera becomes leggy it cannot be brought back to a compact shape. Prostantheras are short-lived shrubs, and pruning helps to prolong their life. They are also surface rooted and very liable to be uprooted by strong wind, so that they need either a sheltered situation or the support of a sturdy stake. As one bush ages another can be planted, so that it is well established to take the place of the one that is finished.

P. incisa rosea is the variety with the pinkest flowers; *P. ovalifolia* and *P. rotundifolia* both grow to about 5ft. with mauve flowers and are in frequent use.

Podalyria calyptrata is a most showy shrub throughout the year, as its rounded silvery foliage is evergreen and glints when the light catches it. This shrub grows to 8ft. with a rather open head, though it may be kept pruned every year after flowering and maintain a compact bush of about 4ft. Its large pink pea-shaped flowers are a pleasing combination with the silver foliage.

P. sericea, South African satin bush, is a much smaller version of *P. calyptrata*. It grows to only 3ft. and makes a compact bush with the same, only smaller, silvery leaves and pink flowers. It makes a most effective hedge where a low subdivision is required. Both podalyrias can be increased from seed.

Of the waratahs *Telopea speciosissima*, N.S.W. waratah, is the one most commonly grown, though the Victorian and Tasmanian waratahs are sometimes used in colder districts. As soon as a waratah is planted the top should be pinched out to cause branching and after flowering they can be cut back hard into the wood of the previous year's growth to keep the bush compact. If this is not done, like many other Australian shrubs growing under New Zealand conditions, they rapidly become top heavy, so that a strong wind is sufficient to blow them over. Spent flowers must be removed, because if seeds are allowed to set, new growth is short and flower production decreases.

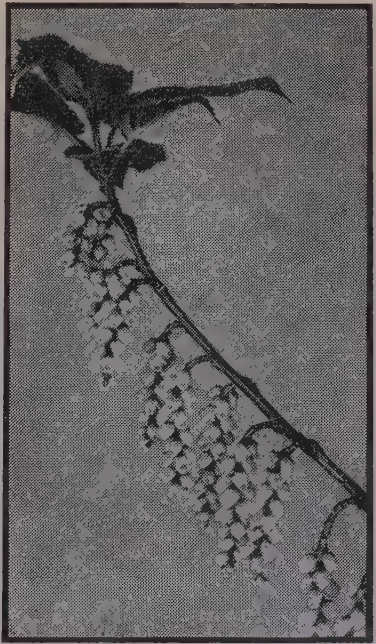
[Douglas Elliott

Leptospermum scoparium keatleyi, a good variety of large pink-flowered manuka.

Fremontia californica and *F. mexicana* are so similar as to be taken for the same shrub. Fremontia grows to a height of 10ft., with an upright pyramidal shape. The flowers are flat, being pale yellow inside and brickish red outside, and the effect of the shrub is yellow and brown. Though not fully hardy, it will stand a few degrees of frost. The hairs from the foliage may have an irritant effect on some people. The flowers last well when cut.

Leucospermum reflexum is a South African shrub which has leapt into popularity over the last few years. This shrub grows to a height of 15ft. to 20ft. and makes a large, striking bush with its long, silver foliage, and its dense, upright habit. In spring the bright orange-red flowers are exceptionally showy and last well on the bush or when cut. Leucospermum is a plant which does not need coddling and which prefers an exposed windy position. In sheltered areas moisture lodges in the tips of the branches and causes rotting there. As it prefers an exposed situation and forms a massive, dense bush, this is an excellent subject for garden shelter.

Isopogon leucocephalus grows to a height of 6ft. and is not in frequent use, though it deserves to be. Its foliage is stiff and fernlike and the flowers of lavender blue are freely produced and stand up well to adverse weather conditions.


[Douglas Elliott

Stachyurus praecox.

The mays or spiraeas, with small white flowers, sometimes single and sometimes double, make a graceful contribution in spring. They are easily increased by division and in fact that is the way they have survived; their names are obscure, but they can still be found in practically every garden.

Escallonia exoniensis and *E. rubra*, the two escallonias commonly grown as hedge plants, can also be used most satisfactorily as fillers in a shrub border. Pruned to a good shape, they can give height or density where required, and as they root easily from hardwood cuttings in winter, it is not difficult to strike a cutting where a plant is required.

Abelia chinensis, another hedge plant, is also most useful as a filler or for stopping a draught in the garden. It can be kept trimmed or allowed to branch freely. In the latter case, old twiggy growth should be cut out, as more flowers are produced on young growth.

Though *A. chinensis* is quite ornamental with its brown foliage and pink bracted white flowers, two other species, *A. schumanni* and *A. floribunda*, are far more spectacular. *A. schumanni* grows to 6ft. and has a spreading habit and produces large tubular soft pink flowers. The flowers of *A. floribunda* are even more conspicuous, being bright rosy red. *A. floribunda* was the name formerly given to *A. chinensis*, the hedge variety, and confusion still exists. The two ornamental varieties can be raised just as easily from cuttings.

Hard, Dry Situations

In a garden often there is some part which has rather poor soil and which dries hard in summer, and though many plants may be tried there, the number of failures is usually very high. In such places it may be possible to grow one of the following shrubs:—

Spartium junceum, Spanish broom, makes a rich display with its profuse yellow flowers borne on green rush-like leafless branches. It stands the driest conditions and flowers for a long period. It lives 8 to 10 years and

[Douglas Elliott

Magnolia stellata bears a profusion of scented white flowers in late spring.

can readily be increased by hardwood cuttings in winter or from seed. Pruning should be carried out after the main flowering season. Winter pruning upsets the balance of the plant. As it is inclined to become leggy, it is better in the background planting.

Cytisus hybrids, brooms, range from crimson to mauve to yellow and make an excellent cover planting on a dry bank, as they are colourful for about 6 weeks. Pruning should be carried out each year after flowering to prevent seed setting and to keep the bush compact. Brooms are not difficult to increase. Hardwood cuttings may be taken in winter or seed sown, and it is worth while to have a few young plants coming on to replace the older plants.

Cistus, rock rose, grows rapidly and if kept hard pruned is a pleasing shrub throughout the year with its neat grey-green foliage. The flowers, which last only a day, are freely produced and unfold with a silky sheen. Colours range from white, yellow, and pink and sometimes have a dark blotch on the throat. Cistus are short lived, but pruning helps to prolong their lives.

Grevillea oleoides and *G. rosmarinifolia* grow to a height of 4ft. and after many years will occupy an area of 5 square feet or more, though severe pruning may restrict this size. These grevilleas have neat needle-like foliage and the brilliant red spider-shaped flowers are carried in clusters along the stems.

Ligustrum ovalifolium, privet, commonly used as a hedge plant, can be a most useful ornamental shrub under the driest and most adverse conditions. It forms a graceful spreading shrub of 8ft. to 10ft. and has a good covering of white flowers in spring. As well as flourishing in poor soil it will stand root competition and quite a bit of shade from overhanging trees.

Polygala grandis flowers for 10 months of the year and will do so whether it is looked after or not. Growing to a height of 6ft. with neat evergreen foliage and purplish flowers, it is a most useful plant for a hedge, windbreak, or screen. *P. virgata* is totally different in habit of growth, looking more like a pendulous broom, and in spring the darker purple flowers are loaded along the leafless green branches. As it is very difficult to prevent this shrub from becoming leggy, secure staking is necessary if it is to be saved from wind rocking.

"Acid Loving" Shrubs

"Acid loving" shrubs, azaleas, rhododendrons, luculia, kalmia, daphne, andromeda, ericas, and camellias, prefer their roots to be cool and moist throughout the year without being waterlogged in winter. The term acid loving is used to indicate that they do better in a soil which is more acid than alkaline. Gardens in limestone country or in soil with a high calcium content do not suit these shrubs. As there is often a difference between varieties, certain districts may have better results with one or two varieties of erica or rhododendron and not be able to grow the others at all.

Where soil conditions are to be improved for any shrubs of this group the first consideration is to improve the humus content either by mixing well-decayed compost into the planting hole some time before planting or by surface mulching once the plants are in. Mulches should be spread only on damp ground, and whether hay, straw, or compost is used, 2in. depth at one dressing is ample. Later on, as the mulch rots and weathers down, a further dressing may be made. Where sawdust is used as a mulch blood and bone fertiliser at 4oz. per square yard should be applied before the mulch is laid on.

Little pruning is necessary on any of this group except the removal of spent flowers where possible, but with ericas pruning back each year after flowering is needed to prevent the bushes from becoming leggy.

Failure of rhododendrons to flower may be due to waterlogged winter conditions, to planting them in a draught, or to their drying out in summer. The middle of a wide expanse of lawn is about the worst place for any of these shrubs, and they cannot be expected to do their best there. Where the soil is moist, well drained, and rich in organic matter and where the situation receives dappled light or some shade during some part of the day reasonably good results may be expected.

Small Trees

In all but the smallest gardens there will be room for some trees. Anything too large would dominate the scene, so that small trees and those with a neat growth habit are the most suitable in the average garden.

Cornus capitata grows to a height of 13ft. and is an ideal small tree for a town garden or it can be used most effectively to line a drive, though the ripe fruits falling in autumn are a disadvantage. Used as a specimen tree it can be pruned and trained to form a good umbrella shape, which allows the flowers to be shown to full advantage. Once established it stands dry conditions. Cornus can be raised from seed sown outside. The creamy bracts surrounding the flowers are showy and look very fresh in contrast with the green foliage. In autumn the fruits turn to red and purple and are equally as effective as the flowers.

Laburnum anagyroides (*vulgare*) is really a small tree of 15ft. Laburnum grows readily from seed, though it is slow to grow and come to flowering. It is a most useful plant, especially for town gardens where space is restricted and where some tree is required for shade in summer or for height. It can be grown either as a single specimen or at the back of a collection of low-growing shrubs. The chains of yellow flowers are produced freely and contrast well with the dark green foliage. If crowded among other trees its shape becomes straggly, but grown as a specimen and trained where necessary, it develops a neat oval head. *L. vossi* is more upright and has longer yellow tassels.

Another yellow-flowered tree is kowhai; there are two varieties, *Sophora tetraptera*, the larger-flowered variety with flowers of a brighter colour, and *S. microphylla*, with a distinct twiggy juvenile stage and greenish-yellow flowers. Both kowhais may be increased from seed. As the seed has a very hard coat, it should be soaked in hot water before planting it in damp ground.

Cercis siliquastrum, Judas tree, is an easily grown tree which can be used as a specimen for shade or to give height in the smaller garden, as it grows to about 15ft. It can also be grown under taller trees, as it will stand some root competition and shading, though naturally it is not so satisfactory under these conditions. The Judas tree has deep pink pea-shaped flowers which cluster tightly along the

[*Douglas Elliott*

Garden varieties of prunus. Left—*P. persica*. Right—*P. nipponica*.

bare branches before the leaves develop. The leaves are rounded and quite effective and in autumn turn yellow. Pruning to shape is all that is necessary.

Stachyurus praecox has a similar habit of growth to a cherry and grows to a height of 10ft. During early spring its glossy brown branches carry festoons of creamy flowers. Its individual flower formation is so distinctive from the prunus and cherries flowering at this time that it is a plant which will always arouse interest.

Many varieties of prunus flower during spring. *Prunus mume* variety The Geisha is the earliest, with small flat bright red flowers produced on dark twigs and branches, and grows to a height of 10ft. *P. campanulata* is close to it with clusters of bell-shaped deep rose flowers which create a striking effect over the full range of the tree's height of up to 25ft. The flowering almonds, *P. amygdalus*, grow to about 15ft. and are also early flowering, the white preceding the pink by a few days. The individual almond flowers are about the largest of the prunus flowers except for the cherries, *P. cerasus*. The cherries in their pink, white, or green varieties are true favourites, and can be used for shade, to line a drive, or as specimens.

The flowering plums of which *P. cerasifera blireana* is one, grow up to 10ft. or more. As well as giving spring flowers they are outstanding for their dark purple foliage, which makes a contrast in the garden and is most useful for cutting.

P. subhirtella pendula, height about 8ft., makes a most graceful weeping tree when all the fine horizontal branches are clothed in flowers.

Magnolias, though growing to large trees of 15ft. or more, make an outstanding garden display. *Magnolia soulangeana* is the kind most commonly grown. It has large pointed flowers, the petals being white with a purple backing. This tree is frequently referred to as the tulip tree, though that name is used for *Liriodendron tulipifera*, whose flowers are truly tulip shaped. *M. soulangeana lennei* is also freely grown; the purple backing on the petals is richer and the flowers are far more rounded than those of *M. soulangeana*. *M. parviflora* is also grown, but does not equal either in full flower or in leaf the grandeur of the other two.

[*Douglas Elliott*

Prunus pissardi var. *wrighti.*

Garden Work for July

July may be regarded as the last month of the old gardening year and is a good time to clean up neglected areas where long rank grass and weed growth are providing safe harbourage for garden pests including slugs, slaters, and snails. Cleaning away this rubbish from fencelines and hedges allows light and air to penetrate so that frost and cold weather can kill garden pests.

Shrubs

Planting of hardy deciduous trees and shrubs may still be carried out where the condition of the soil permits it. Where the soil is poorly drained or waterlogged, shrubs should not be planted in this soil, but heeled in on a well-drained shady site until soil conditions are more favourable. In areas subject to summer drought the sooner shrubs are planted the better chance they have of establishing a vigorous root system to enable them to withstand dry weather conditions.

Sub-tropical plants and evergreens, in most cases, should not be planted yet. These plants establish better if moved in August or September, when growing conditions are more favourable.

July usually provides the opportunity to move shrubs which were found to be unsatisfactory in their present positions. Before an established shrub is moved it is well to consider the new position and make sure that it is really more suitable than the old one. For example, camellias, rhododendrons, and azaleas should be moved where they will have a cool moist root run, and should not be planted too close to fences, hedges, drives, or windows. If shrubs are moved without due consideration of their size and habits, it is possible they will not be any more satisfactory in their new positions.

When an established shrub is moved it should be lifted with as much as possible of the roots and soil intact, and should not be allowed to dry out. Once the shrub is in position the top growth should be reduced by about a third so that it is in balance with the reduced root system. All weak and spindly growths should be cut out first; then, if necessary, the main branches may be cut back. Too large a top supported by a reduced root may mean the plant struggles to keep alive the first year and makes no new growth.

Where a portion of the garden loses the sun early it may appear colder and darker than it really is, especially during winter. In such cases coloured or variegated foliage, particularly golden leaves of a shrub or tree, will do much to brighten it. Shrubs suitable for this purpose are any of the many forms of golden conifers, the variegated forms of karaka (*Corynocarpus laevigata variegata*), lacebark (*Hoheria populnea variegata*), the creamy leaved veronica (*Hebe andersoni variegata*), and tarata (*Pittosporum eugenioides*), which is not really gold but light golden green. Though these trees are ideal as a contrast for dark foliage, too much gold in the garden, especially in full sun, can become tiring.

Roses

Rose pruning may be started in districts not subject to late frosts. Pruning encourages the development of young growth, and if it is carried out too early, the succulent young growth is liable to be cut by frost, which gives quite a setback to the bush. Main rose pruning is carried out next month, when there is less likelihood of young growth being frosted.

Before pruning is started knife, secateurs, and saw should all be sharp, as sharp tools cause the least damage. All cuts should be made ⅛in. above a bud.

When climbing roses are being pruned, sufficient twine should be on hand to tie in the branches once pruning is completed.

Tools

Clean, sharp tools with good handles are a necessity. Poor tools lead to poor workmanship and make the job harder. Spades and hoes coated with mud or clay are cumbersome and difficult to handle, and as the metal becomes pitted with rust, they become more difficult to keep clean. It is not hard to keep tools in good order, especially if they are rubbed over with an oily rag after use. Broken-handled tools should be repaired or discarded, as they often constitute a danger, especially if the wood splinters easily. Where a small tool is inclined to be lost a band of coloured paint on the handle makes it easier to find among the plants.

The Soil

Many home gardens have been established for years, and in hoeing, cultivating, and weeding of the ground it has been left bare and exposed for considerable periods. Gradually over this time the humus and plant nutrients in the soil have become depleted. This is specially so where both feeding of the soil and mulching have been overlooked.

The results of such treatment are well known. Light soils become powdery and nearly lifeless in dry weather; heavy soils set so hard that watering makes little impression. Plants become smaller and smaller in succeeding years until they are starved and mediocre.

Rebuilding a soil when it has reached this state is a long slow business and can only be done by the constant return of decayed plant life to the soil to build up the supply of humus. The principal method is to compost everything that is suitable from the garden and kitchen. Material composted should be healthy. Diseased plants and plants infested with aphis, scale, or other insect life should be burnt, as well as weeds which have gone to seed. The heat of compost is usually not sufficiently high to kill fungous spores or weed seeds.

The ashes of burnt plants can be added to the heap or broadcast over the ground, but in either case they should not be put on in a thick layer. Little more than a dusting on the surface is all that is needed because once ashes are wet they form a sticky impervious mass which prevents the circulation of air as well as the percolation of moisture into the soil. Ash from coke or coal fires is harmful and should not be used on the soil.

Sawdust, wood shavings, seaweed, and farmyard manure can all be composted. A layer of any of these materials alternating with a layer of garden rubbish breaks down satisfactorily and augments the compost.

Once this material has rotted it can be distributed over the garden and worked into the top 4in. to 5in. of soil or used as a mulch round the bases of trees and shrubs.

Wood shavings and fresh sawdust, if not allowed to rot in the compost heap, are best used as a mulch. If they are broadcast as a mulch, the weathering action of rain and rain-splashed mud gradually intermingles them with the soil, starting the breaking down processes, and during normal cultivation they are slowly worked into the soil.

Where fresh sawdust and wood shavings are dug in, some form of nitrogenous fertiliser must be used with it; otherwise plant growth will be depressed, and the plants may become yellow and stunted. Decomposition of sawdust is a process in which considerable quantities of nitrogen are temporarily taken from the soil while the process continues. A dressing of 2oz. per square yard of blood and bone or sulphate of ammonia is the minimum quantity recommended to prevent this condition.

Lawn clippings may be used in the compost heap, but they do not break down satisfactorily unless they are mixed with rougher material or soil. Alternatively lawn clippings may be broadcast over the garden after every mowing. Each dressing should be no more than 2in. deep to avoid a non-porous mat being formed as the clippings decay, though a light stirring with the hoe will break this up. Lawn clippings should not be piled round the stems or trunks of plants, whether they are bulbs, perennials, or shrubs, because they generate heat and moisture as they decompose and create ideal conditions for the establishment of fungi, which may enter the plants through a wound in the stem.

Leaves of deciduous trees, oaks, ash, elm, maples, and even willows, if available in sufficient quantity, break down to form leafmould which is a valuable source of humus. The leaves can be composted or may be kept separate. A wire netting enclosure protected from too much rain by trees or overhanging roof is a satisfactory container for preparing leafmould.

Walnut leaves appear to have a depressing effect on some plants and are better left out of compost. Pine needles will break down to form a satisfactory compost. Cover crops of mustard, lupins, or oats are not often practicable in the flower garden among shrubs and perennials, but where new beds are dug in light sandy soils it is preferable to use a cover crop rather than leave it empty all winter. With a heavy clay, however, the weathering action of frost and rain improves the soil structure. Where cover crops are used at least 3 weeks should elapse between the time of digging in and the planting of other crops in the same soil.

Pot Plants

As flowers are scarce in July, pot plants are in good demand. Cyclamen and *Primula obconica* are probably the favourites, and if they can be kept growing healthily, they remain colourful for a long period. Unfortunately many of these plants, which look the picture of health during the first week at home, are gradually reduced to shadows of their former selves.

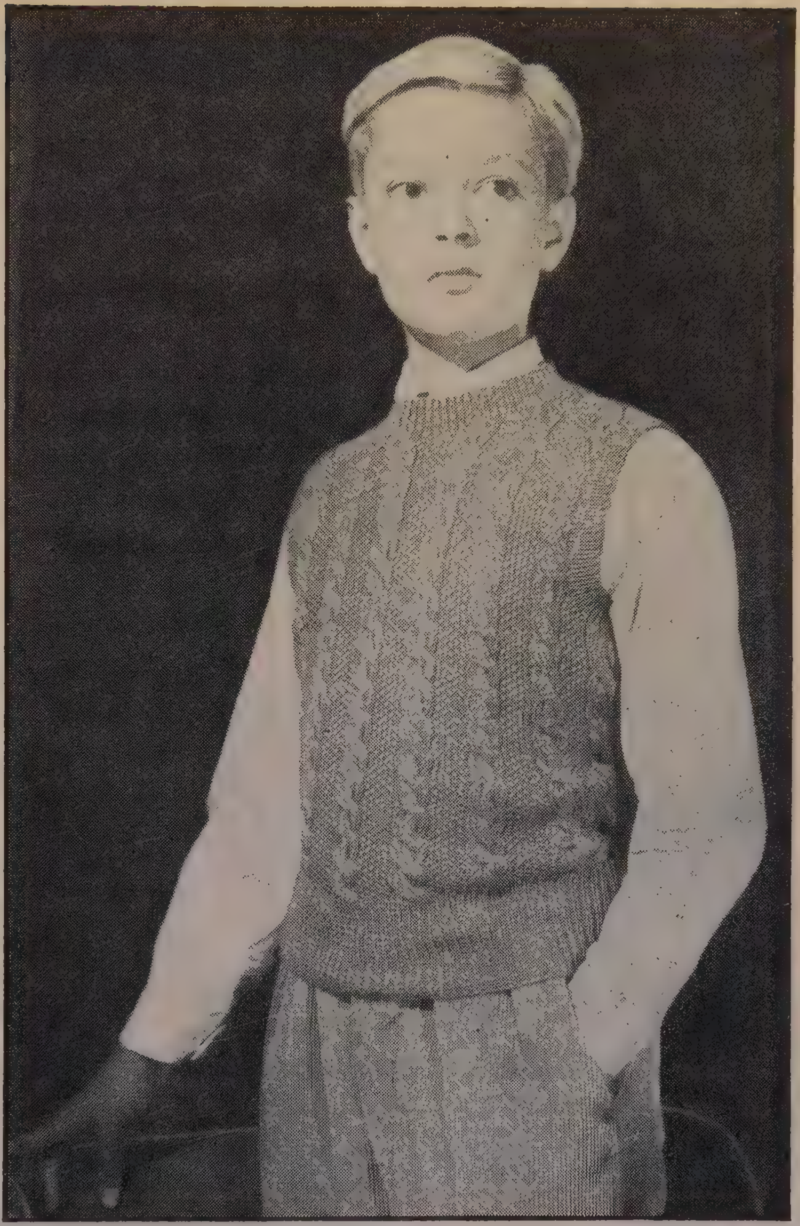
To keep pot plants growing satisfactorily three things need particular attention. The first of these is to be sure they are not placed in a draught, the second is to see that they receive adequate natural light, and last and most important is watering. Water should be given only when the soil needs it; overwatering, causing saturation of the soil, is a common cause of failure.

Water used should be of room temperature and applied to the soil not the plant. Spent flowers should be pulled from cyclamen corms with a sharp tug rather than cut off with scissors. If the ends of the flower stems are not removed from the corm, they have a tendency to rot and may be the cause of the rotting and eventual death of the corm. With cyclamen, cold water poured on to the corm is sufficient to cause the leaves to flag and droop badly. Primulas in wet soil are most susceptible to collar rot, which causes gradual collapse of the plant.

Each pot should rest on a saucer and if surplus water drains through after the plant is watered, the water should be tipped out.

Slipover for Teen-age Boy

THE slipover illustrated at right is stylish and would be a valuable addition to a teen-age boy's winter wardrobe. The pattern is for a 36in. chest, and alternative instructions for a 38in. chest are given also.



MATERIALS: 7oz. of 4-ply wool, 2 No. 9 and 2 No. 12 knitting needles for 36in. chest, 2 No. 8 and 2 No. 11 knitting needles for 38in. chest, and a short spare needle pointed at both ends.

Measurements: Length, 21½in. (23½in.); chest, 36in. (38in.).

Tension: If No. 9 needles are used, 1 patt. (15 st.) measures approximately 2in. when slightly stretched.

Abbreviations: K., knit; p., purl; st., stitch(es); rep., repeat; beg., beginning; cont., continue; patt., pattern; inc., increase; dec., decrease; tog., together; sl., slip.

36in. Chest

Front

Using No. 12 needles cast on 110 st. and work 4in. in k. 1, p. 1 rib. Change to No. 9 needles and work in patt. thus:—

First row: * (K. 1, p. 1) 3 times, k. 8, p. 1. Rep. from * to last 5 st., (k. 1, p. 1) twice, k. 1.

Second row: * (K. 1, p. 1) twice, k. 2, p. 8, k. 1. Rep. from * to last 5 st., (k. 1, p. 1) twice, k. 1.

Third row: As first row.

Fourth row: As second row.

Fifth row: * (K. 1, p. 1) 3 times, sl. next 4 st. on to spare needle, leave at front of work, k. 4, k. 4 from spare needle, p. 1. Rep. from * to last 5 st., (k. 1, p. 1) twice, k. 1.

Sixth, seventh, eighth rows: Rep. second, third, fourth rows.

Rep. these 8 rows, inc. 1 st. both ends of next row and of every fourth row until 140 st. on needle, then cont. straight until work measures 13in.

Shaping the armholes: Cast off 10 st. at beg. of next 2 rows, dec. 1 st. both ends of every row until 100 st. remain. Cont. straight until work measures 19in., ending row on wrong side.

Shaping the neck: Next row: Patt. 40 st., turn. Work on these st. only, dec. 1 st. at neck edge on every row until 24 st. remain, then cont. straight until work measures 21½in., ending at the armhole edge.

Shaping the shoulder: Cast off 8 st. on next 3 rows beg. armhole edge. Leave centre 20 st. on a spare needle, work on last 40 st. to match with first side.

Front neck band: With right side of work facing and using No. 12 needles k. up 30 st. along neck edge, 20 st. from spare needle, 30 st. along neck edge. Work 1in. in k. 1, p. 1 rib. Cast off loosely in rib.

Back: Work as for front to end of armhole shapings. Cont. straight on 100 st. until work measures 21½in., ending wrong side row.

Shaping the neck and shoulders: Next row: Cast off 8 st., patt. 19 st., turn. Work 3 rows on these st. dec. 1 st. at neck edge on each row and casting off 8 st. at beg. of second row, at armhole edge. Cast off remaining st. Leave centre 46 st. on a spare needle, rejoin wool at neck edge, and patt. across 27 st. to armhole edge. Work 3 rows on these st. dec. 1 st. at neck edge on each row and casting off 8 st. at beg. of first and third rows. Cast off remaining st.

Back neck band: With No. 12 needles and right side of work facing, k. up 5 st. from neck edge, 46 st. from spare needle, 5 st. from neck edge. Work 1in. in k. 1, p. 1 rib. Cast off loosely in rib.

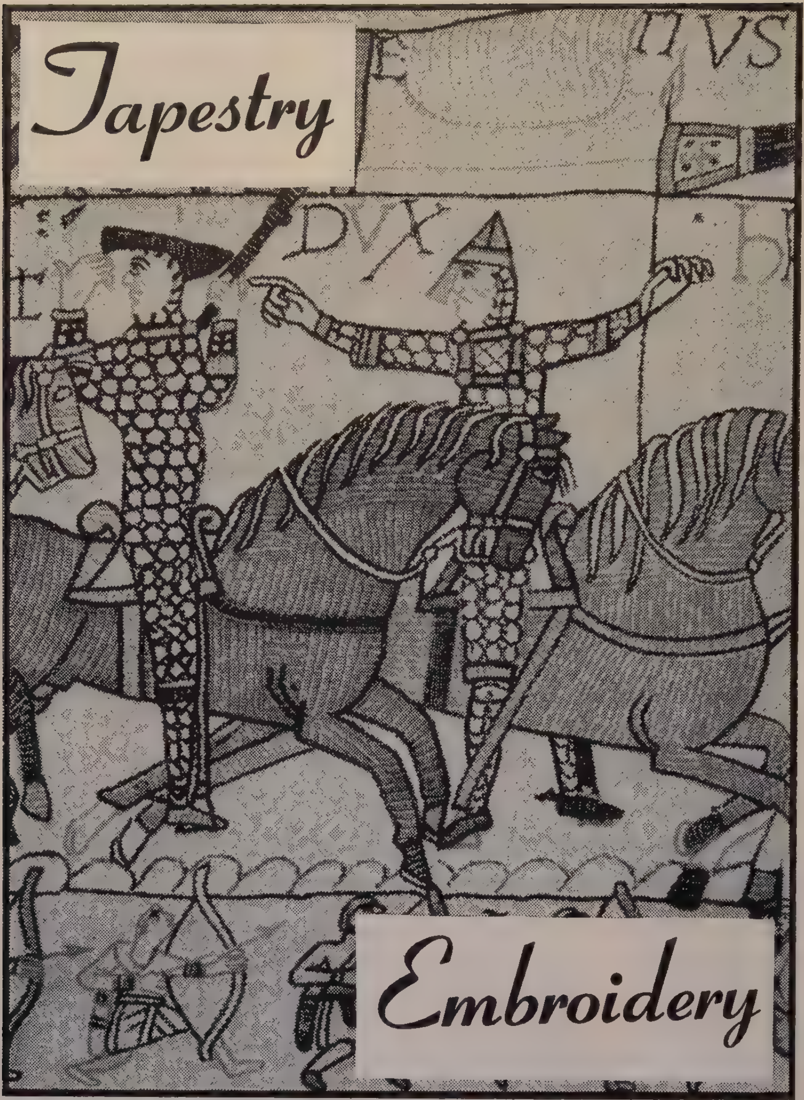
Armhole bands: Join shoulder seams. With No. 12 needles and right side of work facing, k. up 140 st. round armhole. Work in k. 1, p. 1, rib dec. 1 st. beg. of every row for 1in. Cast off loosely in rib.

Make up: Press work lightly on wrong side with hot iron and damp cloth. Join side seams. Press seams.

38in. Chest

Substitute No. 11 needles for No. 12 needles and No. 8 needles for No. 9 needles throughout instructions. Work as given but cont. for 14in. instead of 13in. before armhole shaping, 20½in. instead of 19in. before front neck shaping, and 23½in. instead of 21½in. before shaping shoulders. K. up 148 st. instead of 140 st. round armholes for borders.

Tapestry Embroidery



OFTEN wrongly called tapestry, canvas work or cushion work originated many hundreds of years ago in several countries. The stitchery used was often cross stitch or tent stitch, the ground fabric, of either canvas or linen, being completely covered. Many very fine examples of this type of embroidery have survived, some having been used as wall hangings in churches or in great houses. The famous Bayeux Tapestry, depicting the Norman Conquest of England in the 11th century, is a magnificent example of tapestry embroidery on linen, the result of years of patient labour by expert needlewomen and a designer who was a master of his craft. Not all tapestry embroidery need demand so much in time and extreme care in execution as these historic works, and in this article Betty Johnston, Field Officer in Rural Sociology, Department of Agriculture, Wellington, discusses the choice of suitable designs and materials, the equipment required, and some of the simple canvas stitches.

THROUGHOUT the ages embroidery has been a craft practised by women of many countries. In England even before the Norman Conquest Englishwomen had won European renown for their finely worked church vestments and wall hangings. That this skill has not been lost is shown by the work of the late Queen Mary, who a few years ago completed a magnificent needlework carpet now housed in Canada. In London the Royal School of Needlework has students from all over the world learning to repair ancient embroideries and tapestries, and it was here that some of the Coronation robes, noteworthy for their beautiful and elaborate embroidery, were made.

The requirements of modern life leave the housewife little time to spare for large-scale work, but making such small articles as bags, stool tops, chair seats, and firescreens may provide many pleasant hours of much-needed relaxation. The proper use of needle, thread, and fabric and the disciplined efforts required in embroidery give a sense of confidence and satisfaction and of release from the nervous tension of everyday life.

Canvas or cushion work, where the design is carried out in square stitches on a ground of canvas or coarse linen, is often called tapestry. This is incorrect, as tapestry is a product of the loom. Tapestry embroidery, however, is a term that has become widely accepted as an alternative name for canvas work, but it should not be confused with true tapestry. Once woven laboriously by hand, tapestries are now mass produced on the powered Jacquard loom, but they lose in the process something of the individuality which marks the work of the medieval weaver. This personal stamp, which nowadays is rarely found, may be seen clearly in embroideries which have been designed and worked by the same person.

Trammed and Printed Canvases

Canvases can be bought with the design already printed or trammed. That means that a lengthwise stitch of an appropriate colour has been made over each group of canvas threads to be covered. (See diagram on page 627.) The design and colour scheme are thus clearly indicated, and there is the added advantage of having an extra covering or padding thread incorporated into the work.

For the beginner it is probably best to start with a simple design that has been trammed by an expert. Trammed canvases are more expensive than are stamped ones, but the careful guidance of a good designer is a great help to a beginner and is well worth the extra cost. The secret of good design is in knowing how to balance colour and form against the limitations of canvas and squared stitches. This knowledge comes only with experience. A good designer also recognises the restraints imposed by materials and function. Chair covers should be hard wearing and able to be cleaned and the designs should be suitable for use on chairs. Raised embroideries would be uncomfortable to sit on, and would probably soon show signs of wear. Large patterns which cover most of the canvas are reserved for large stool tops, chair coverings, and firescreens; small articles such as evening bags have daintier and more detailed designs (see illustrations of stool and evening bag).

The stool shown is about 2ft. high, and its bold design of roses is in proportion to its size. The materials used are a fairly coarse canvas and assorted tapestry wools. The roses are simplified and conventional in form, showing very little detail or gradation in colour, and no attempt has been made to achieve a naturalistic effect. Instead a pattern that is almost geometric has been evolved, partly as a result of the stitchery used and the thickness of the wool and partly because of the nature of the ground fabric.

The evening bag is made of very fine double-stranded canvas, with the central sections of the design worked on a "pricked ground". Here the two strands have been parted with the needle and the stitches have been

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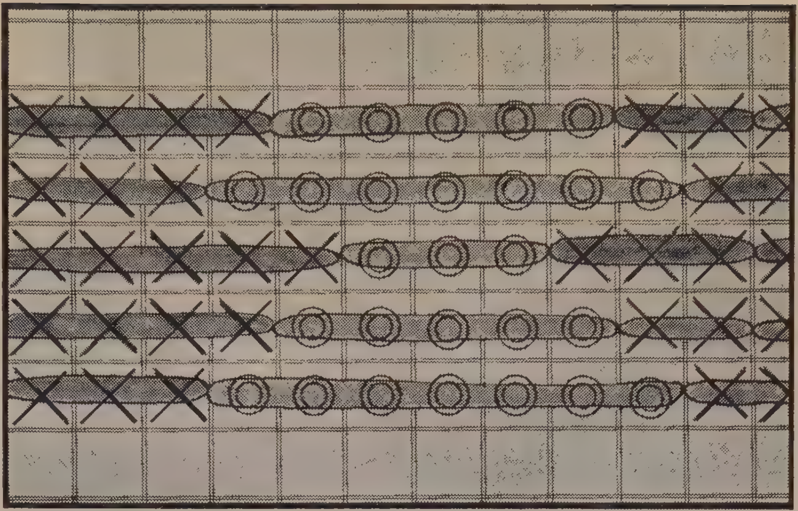
HEADING ILLUSTRATION: A portion of the Bayeux Tapestry.

made over a single strand. As a result, this portion is finer in texture than is the rest of the bag. There is more detail in this design and a greater variety of colours. Nevertheless the form is still conventional.

The Syon Cope, one of the most famous of surviving English church vestments, has a border of coats of arms worked in another square stitch, cross stitch, which is especially suited to heraldic and geometric designs. The decided characteristics of cross stitch are also seen to advantage in some of the 18th century samplers, which are very good examples of restraint and simplicity in design. Unfortunately these admirable qualities are often ignored by modern designers. In tapestry embroidery, as in any craft, it is important to remember that it is impossible to reproduce exactly natural objects and scenes on a flat surface such as canvas. Rather than strive unsuccessfully to make a lifelike spray of flowers or a picture of hounds in full cry it is better to use a stylised or geometric form.

Guided by the lessons of the past the more experienced needlewoman should be able to make her own embroidery designs, drawing them directly on to the canvas. For those who feel doubtful of their ability as designers there are tapestry charts which include simple and accurate working instructions with their designs. Some of these charts, however, are for very poor designs. Naturalistic jars of flowers and cottage gardens may have a sentimental appeal, but they are not a wise or suitable choice for translation on to canvas. There are no hard-and-fast rules for judging good and bad in design; the ability to discern and enjoy beauty, generally known as good taste, is a matter of experience and commonsense.



Tramming a design. The cross and circle symbols represent two different colours in the design. Every row in each group of stitches is covered with a long float thread of the colour selected.

Points for Planning Work

The following points should be considered and may help when a piece of work is being planned:—

1. Suitability

(a) Is the work appropriate to the purpose for which it is to be used? Embroidered canvas is not a suitable medium for portraits or landscapes; photography or painting is a more effective and satisfactory method of reproduction.

(b) Is the work suitable to its place of use? It is not usually considered satisfactory or desirable to have embroidered seat covers on kitchen chairs or needlework wall hangings in a bathroom. Cleaning them would be a problem and they would look out of place.

This stool cover is embroidered in tapestry wools on a coarse screen.

2. Choice of Material and Stitch

The choice of correct fabric and stitchery in relation to the design and the use of the finished work is important. Will the work be subjected to strong sunlight? If so, it should be worked in fadeless cottons or wools. Will it have to withstand hard wear? A dining chair used every day will need to be covered with strong canvas embroidered with strong wools or cottons. Big stitches with long float threads which may be caught and pulled should be avoided. Large stitches used in a small design would look incongruous.

3. Balance

Colour, tone, and texture should be in harmony, and the general effect and finish should be pleasing.

Choice of Materials

Canvas, linen, or any coarse-textured, stout fabric may be used as the ground material in tapestry embroidery. Where hard wear is expected, as for the covers of chairs and stools, it is desirable to choose a heavy canvas and strong, tightly spun cottons or wools. Firescreens, pole screens, wall hangings, and bags may be worked on either canvas or linen, depending on the kind and size of the design to be used. It should be remembered that in canvas work the whole of the ground fabric is to be covered; therefore the wools, silks, and cottons should suit in thickness the mesh of the canvas or linen. Light colours should be worked on a light ground and dark colours on a corresponding dark material, no trace of the

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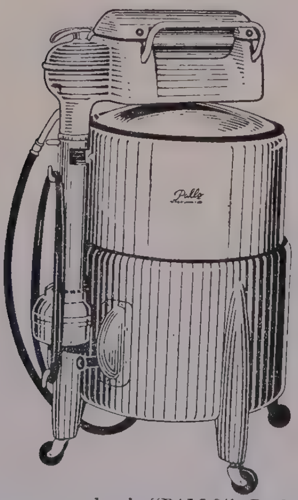

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under fabric being allowed to show through the stitches.

The materials chosen should look and wear well, they should be suitable to the purpose for which the work will be used, and they should be pleasant to work with. When possible the best available materials should be used, for valuable time and labour are spent on the work, and good materials help to spur the worker to her best efforts.

Ground Fabric

Handwoven linen, strong of thread and coarse of texture, is probably the best choice for the ground fabric, but it is not easily obtained and may be expensive. Any strong, pure linen with a coarse mesh may be used for this type of embroidery, although canvas is equally satisfactory. Tapestry canvas usually has its threads arranged in pairs and for this reason is sometimes called double-thread canvas. The usual width is 27in.

Thread and Wool

It is important to buy all the wools or cottons at one time, as even slight variations in the dyes of later batches will show in large, flat blocks of colour such as backgrounds. The assistants in needlework shops or at counters should be able to suggest the required amounts when the canvas is bought. Tapestry and embroidery wools have fewer twists spun into the yarn and give a smoother finish than does ordinary knitting wool. Fadeless, stranded, mercerised cotton is the best choice for fine work or for combining with wool to give a contrasting effect. Silks may be used effectively either alone or combined with cottons, but they should be colourfast and suitable for embroidery.

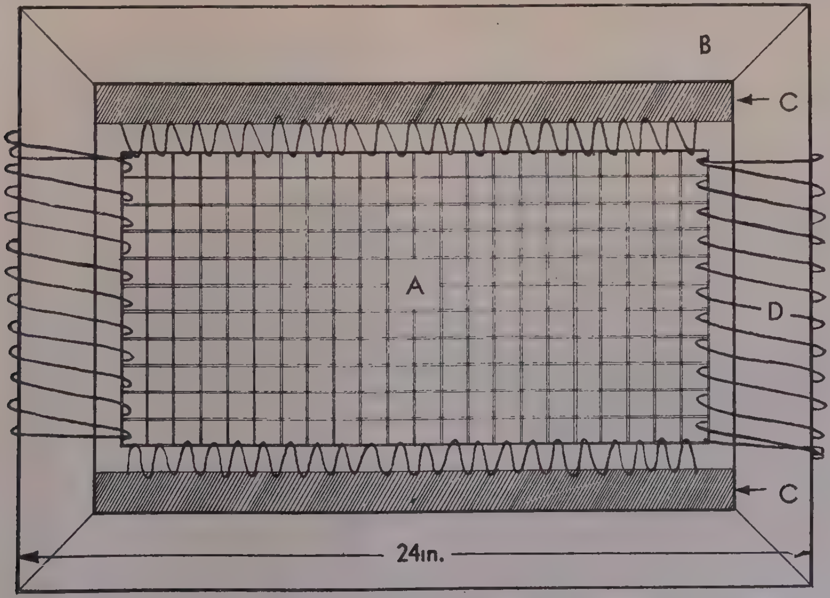
Needles

Tapestry needles have blunt points and are made in various sizes. The needle chosen should be of good, rustless steel and should not bend. The eye should be cleanly cut and of a size that will easily hold the wool or thread.

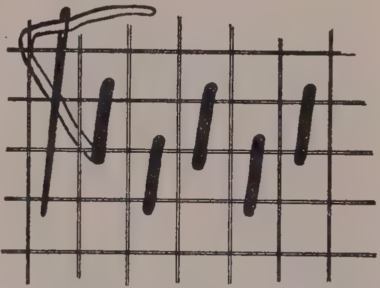
A petit point evening bag made on a fine canvas which had been trammed by a designer in Vienna. The central section has been worked in single-strand cottons on a pricked ground to give a finer and more delicate effect.

Frames

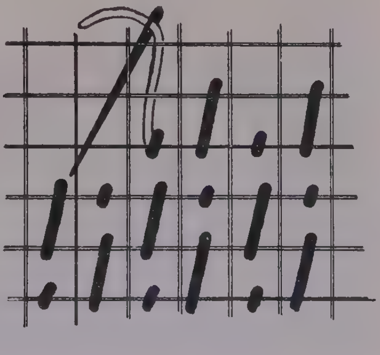
Embroidery or tambour frames may be used to hold the work. Circular tambour frames are formed of two hoops fitting closely one within the other and are usually made of wood. The material is stretched between the hoops, which should be big enough to contain the whole of the work, as the parts imprisoned under the hoops are liable to be stretched out of shape or marked. An embroidery frame fitted with rollers and screw sides is better for big canvases. An ordinary 24in.

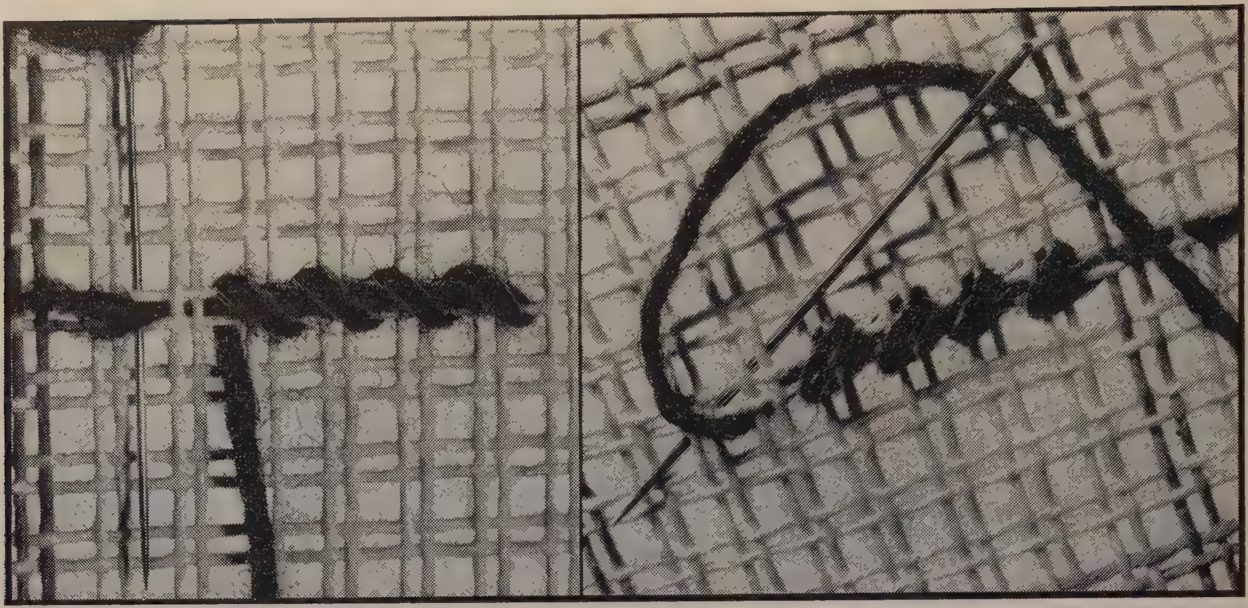


A home-made embroidery frame made from a picture frame. Webbing is nailed on the upper and lower edges. A—Canvas. B—Frame. C—Webbing. D—Laced string or thread.



Hungarian stitch. Above—A vertical stitch crosses two threads of canvas, each stitch being one strand apart. The second stitch begins opposite the middle of the first one; this gives an interesting stippled effect. Below—Alternate long and short stitches are used, the first stitch passing over two strands of canvas and the second over one strand.





Two tapestry stitches. Left—Tent stitch or petit point. Right—Gros point or big stitch.

picture frame makes a good home-made embroidery frame (see lower left diagram on page 629). Webbing is nailed on to the upper and lower edges and the canvas is overcast to this. Strong thread or string is laced through the sides of the canvas and over the sides of the frame. A small stand may be fixed to the frame or it may have a wooden clamp attached so that it may be fastened to a table. This frees both hands for work. One hand is kept on top to pass the needle through the canvas and the other hand is underneath to receive the needle and return it up through the canvas again.

Scissors

Ordinary scissors can be used, but special embroidery scissors with fine blades tapering to sharp points are recommended. Small surgical scissors with straight blades and sharp points make excellent embroidery scissors. Cutting shears are needed for trimming the canvas, a task which is too heavy for small scissors and might cause damage to the small blades or rivet.

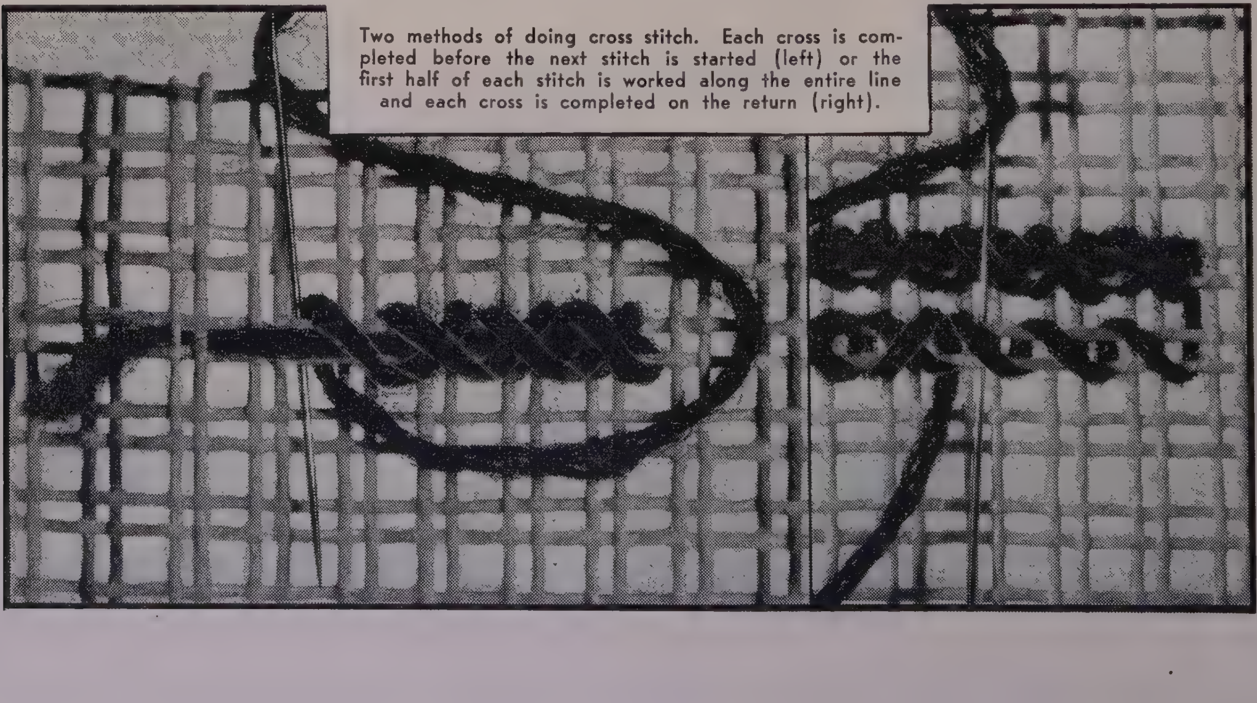
Thimbles

It is strongly recommended that thimbles be used for canvas work, especially for the heavier grades of canvas. Steel is the most serviceable material, but silver is often used to make thimbles which will last for a lifetime. Nowadays plastic is the most usual thimble material, and its comparatively low cost makes it a prudent choice for the needlewoman who may be inclined to lose small pieces of equipment. One way of overcoming this difficulty is to keep equipment—scissors, thimbles, cottons, pins, and needles—in a strong cardboard box or in a padded work-box.

Canvas Stitches

Tent stitch, petit point, or half cross stitch: A diagonal stitch is made from the left up to the right, crossing over two strands of canvas each way. The needle is passed vertically downward beneath the canvas between each stitch.

Big stitch or gros point: This is a back stitch which is worked from the right hand side of the canvas. The



Two methods of doing cross stitch. Each cross is completed before the next stitch is started (left) or the first half of each stitch is worked along the entire line and each cross is completed on the return (right).

stitch crosses diagonally over two strands of canvas, the thread at the back being longer and more slanting.

Cross stitch: There are two ways of making cross stitches; each cross is completed before the next is started, or the first half of the stitch is worked along the entire line and the cross is completed on the return journey. The crossing must always be worked in the same direction. The stitch is worked from the left up to the right, as in the tent stitch, crossing over two strands of canvas each way. The needle is passed vertically downward behind the canvas between each stitch. The cross may be completed with each stitch, or after a row of half cross stitches has been made.

Straight Gobelin stitch: This stitch, a vertical one, is worked over two parallel threads of canvas. This gives a ribbed or corded surface.

Hungarian stitch: Many variations of this stitch are possible and it is very useful when a shaded effect is needed. Double thread canvas is not suitable for this stitch, unless the ground is "pricked". Two variations of Hungarian stitch are shown in the lower right diagrams on page 629.

Working Instructions

Begin with the pattern, working from the centre outward. Coloured threads which are used for a few stitches to form part of a pattern should be brought through to the front of the canvas at convenient points on the unworked ground and held there until they are needed again.

Do not use knots, but run the thread along underneath for about an inch, occasionally catching a strand of the canvas, and make the stitches over this thread.

Care should be taken that the tension of the stitch is not made so tight that the canvas buckles.

Straightening the Canvas

Tapestry canvas is inclined to pull crooked during working, but it is not difficult to straighten after finishing. Illustrated on this page are two steps in the process. The completed work is gently pulled into shape and pinned on a board, with the right side up. Several sheets of damp blotting paper are placed over the canvas, which is left under a weight. If it is necessary, re-pin and adjust the embroidery until it is quite straight. A light press with a steam iron or a damp cloth on the wrong side may be necessary for a perfect finish.

Making up and Mounting

Screens are mounted over strong board, with the edges of the canvas laced together at the back with strong thread or string. Chair and stool covers are best mounted by an upholsterer, but they are quite satisfactory if they are treated as ordinary furnishing materials. Bags may be stiffened with light cardboard cut to match the shape of the bag. The seams are made on the wrong side, and a lining of silk or taffetas made to match. This is attached to the top or frame of the bag. Frames are available in various sizes and shapes, some expensive and rather ornate and some of moderate price and simpler in style.

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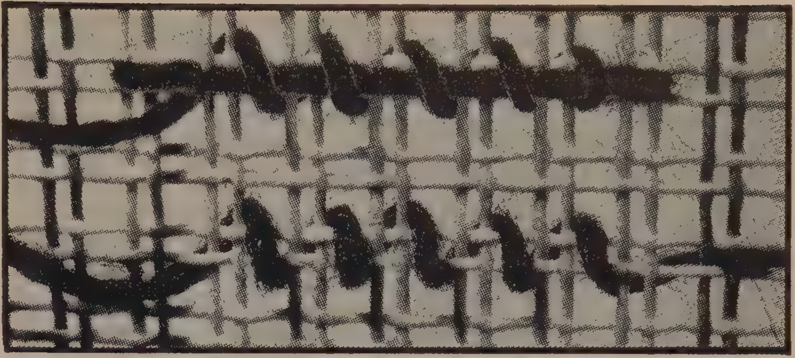
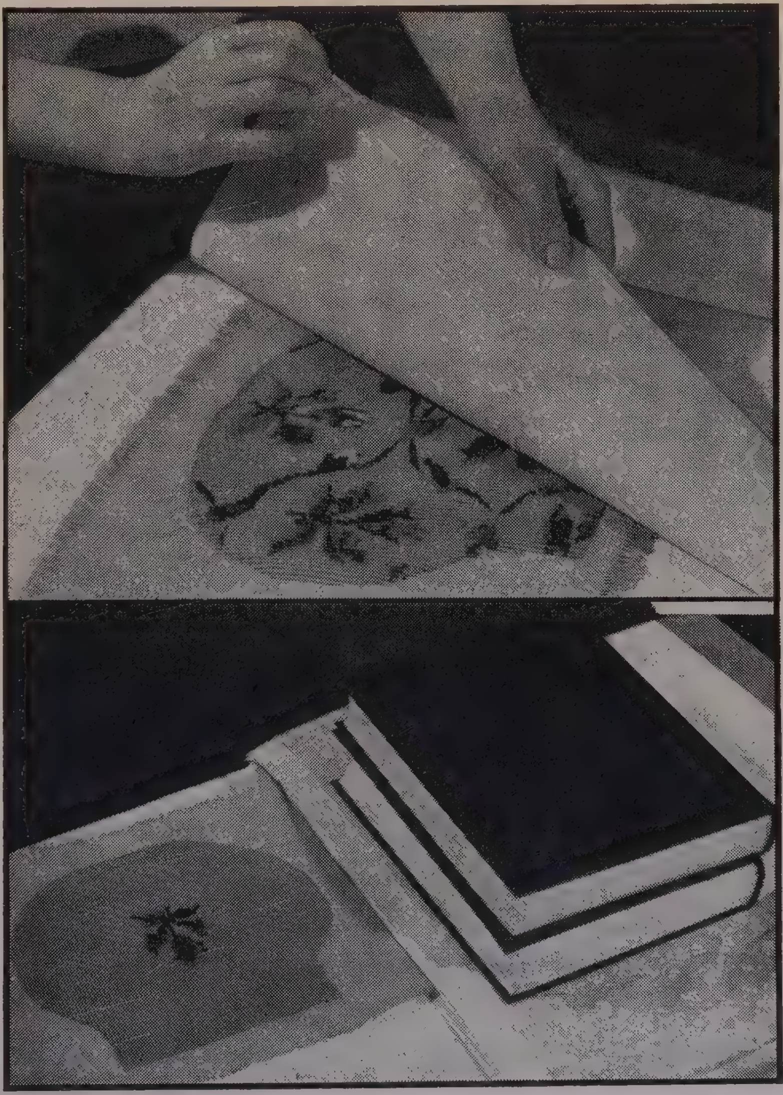
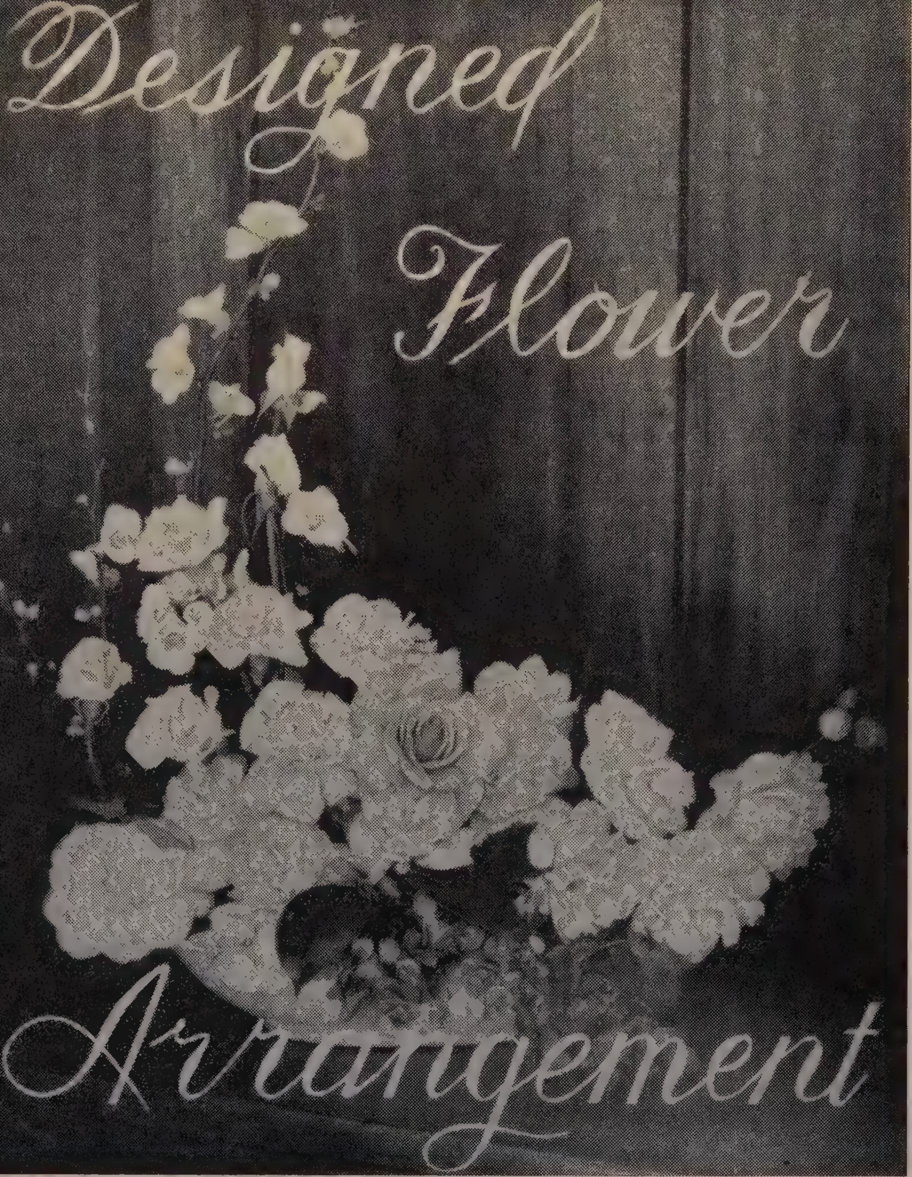


Straight Gobelin stitch can be done in two ways. Upper—The stitch is made over trammed ground. Lower—The ground is left untrammed.



Straightening the finished canvas. Upper—Damp blotting paper is placed over the canvas. Lower—Heavy books, protected from the damp blotting paper by a layer of plastic, act as weights to press the canvas into shape.

Designed Flower Arrangement



TO study the theory of colour in flower arrangement in detail is beyond the scope of these articles, states Margaret O'Brien, Horticultural Department, Massey Agricultural College, Palmerston North, in continuation of her series of articles on designed flower arrangement. It is a fascinating study, and there is plenty of literature available on the subject. A description of the use of a colour wheel, the value of the four most important colour schemes, colour design, and a few notes on colour psychology will suffice as an introduction to the subject. Most flower lovers have naturally a good colour sense, but it is a sense which can be improved immeasurably with careful practice. The pleasure of suddenly creating an outstandingly beautiful arrangement has to be experienced to be fully appreciated.

THEORETICALLY the colour wheel is made up of the colours of the rainbow, the component parts of the ordinary white light around us. A colour wheel should always be turned so that red is at the top and green at the bottom. Red is a purely arbitrary starting point, but it is of course essential that one colour be universally recognised as the starting point from which the rules of colour can be standardised.

Definitions of Colour

Primary Colours

The primary colours are red, blue, and yellow. Varying combinations of these produce other colours; for instance, blue and yellow become green, blue and red become purple, red and yellow become orange. Some colour systems regard red, blue, yellow, green, purple, and orange all as primary colours.

Secondary Colours

Secondary colours are the divisions between the primary ones, such as red-violet or orange-red.

Tints, Shades, and Tones

Black, white, and grey are not regarded technically as colours; their addition to any given colour brings about a change. For example, if white is added in increasing quantities to blue, the result will be a lighter and lighter blue until, in theory at least, the blue is completely washed by the white. The resultant range of blues will all be "tints" of blue. In the same way the addition of black to blue will give a range of darker and darker blues, known as "shades" of blue. The addition of grey to blue will produce "tones" of blue.

Ascending Colours

Ascending colours are the warm colours from pure red to pure green on the left side of the colour wheel.

Descending Colours

Descending colours are the cool colours from pure red to pure green on the right side of the colour wheel.

Colour Schemes

Monochromatic

A monochromatic colour scheme is based on one colour and variations in the form of tints, shades, or tones of that colour. For example, if red is used as the basic colour, one can visualise an arrangement of roses in red, lighter red, medium pink, palest pink, and white as a monochrome in red and tints of red. Bearded iris might well make up an arrangement which called for tints, shades, and tones of purple.

Theoretically a monochrome is the simplest of colour schemes, being based on one colour, but in fact it can be very difficult to achieve, for flower colours are not like simple pigment colours from a paint box, but are often composed of one layer of coloured cells laid on another, until the final colour effect is well nigh undefinable. If, for instance, the monochrome is to be in blue-red, it must all be in tints, shades, and tones of the basic blue-red, which must not suddenly become bluer or redder; neither must it change from a blue-red to a yellow-red if it is to be a true monochrome.

As a monochromatic colour scheme deals with tones, tints, and shades of any one chrome, and as it is merely a matter of selecting one chrome or colour from the colour wheel and working with various gradations of that colour, a mask would be of no assistance. The colour can be included with the tones, tints, and shades if required.

The container for a monochromatic arrangement must be the basic colour or pure white or one of the tints, shades, or tones used. It is by no means necessary to use many variations of the basic colour; very striking arrangements can be achieved by using the two extremes of a monochromatic range, for instance, blue flowers in a white container, or red flowers in a black container. Such sharp contrast is dramatic in its effect and would need a carefully chosen setting, a stage, or perhaps a very modern room, but certainly not a soft, elaborate, old world atmosphere.

Analogous or Neighbouring Colours

Colour analogy, as the name suggests, is made up of a series of colours which follow each other in sequence on the colour wheel. There may be flowers, zinnias for example, of only two colours such as red and orange-red in an orange-red container, or

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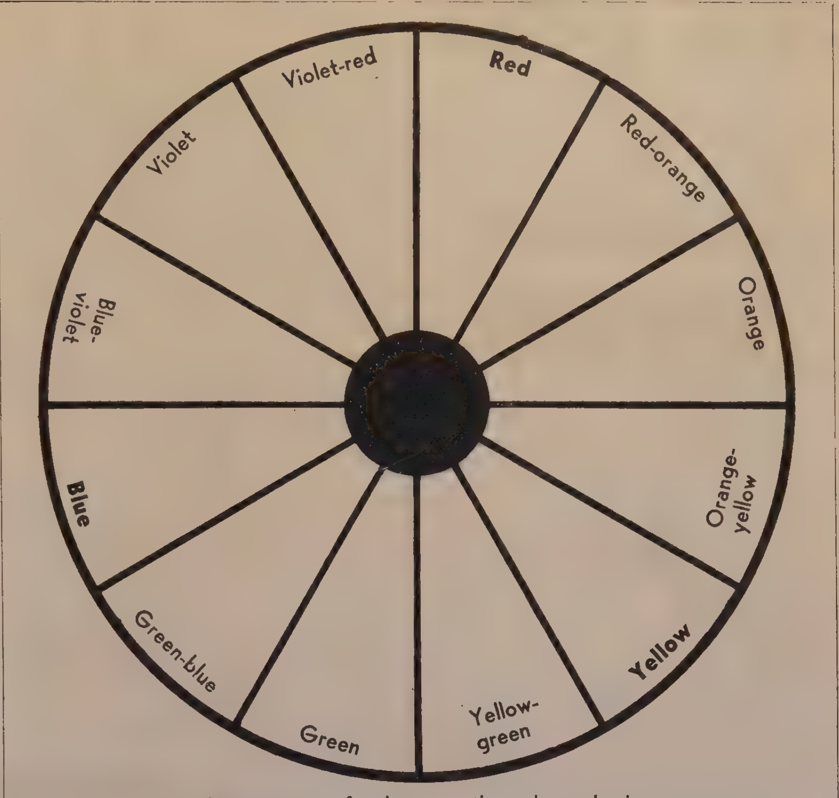
Heading photograph by Perry.

there may be the whole range of ascending colours, red, orange-red, orange, orange-yellow, and yellow, with yellow-green and pure green foliage in a container which is any one of those colours. An analogous arrangement may be made up of two or all of the colours in sequence on the descending side of the colour wheel, but it is not possible to combine ascending and descending colours for this type of colour scheme. For example, though the combination of blue-red, red, and orange-red zinnias could be used, such a combination obviously would never give good colour harmony. Colours opposite one another on the colour wheel combine readily, as will be seen in the next colour scheme described, but ascending and descending colours will not combine in sequence.

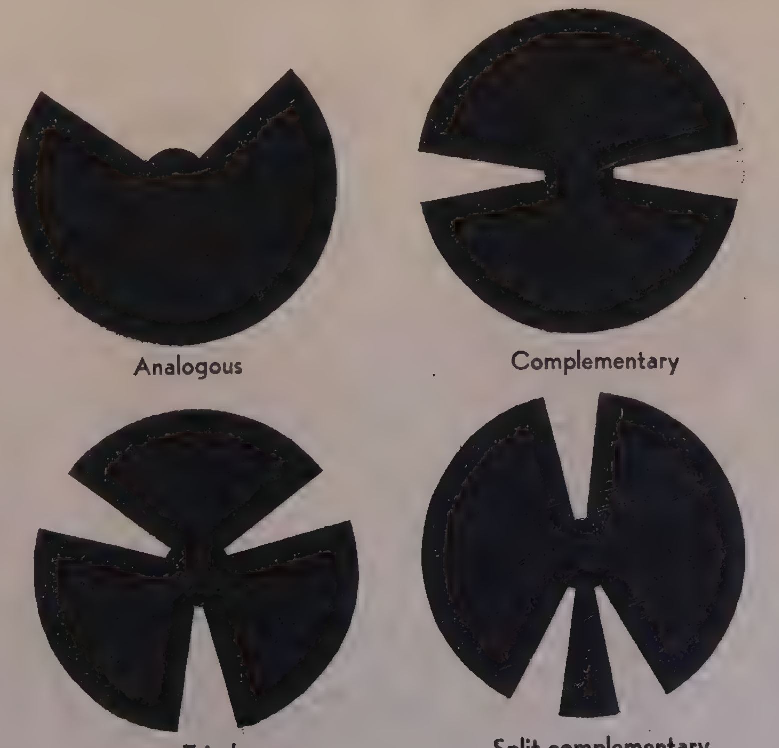
For an analogous colour scheme to achieve the maximum effect all the colours used must be of equal value; that is, they must all be pure colours or they must all be combined with the same quantity of white, black, or grey. For example, an arrangement of pure red, orange-red, and a pale tint of orange will lose in dramatic effect; the tint of orange will not of course cause a discord of colours, but it will appear even paler and weaker than it actually is, causing an otherwise strong colour scheme to lack character. As analogous colour schemes are often best suited to settings which require dramatic, bold flower pieces, all the colours used are usually pure. For a pastel effect it is safer to choose one of the other schemes.



Arrangement of colours on the colour wheel.

Complementary

Complementary colours are those directly opposite one another on the colour wheel—red and green (which so frequently appear in nature), yellow and violet, orange-red and blue-green (an example in flower arrangement would be a combination of the old orange lion-tail, *Leonotis leonurus*, and a clear blue delphinium), and so on round the colour wheel. In designs using pure complementary colours the effect is again bold and strong, suitable for a stage or very modern surroundings; a combination of soft tints, tones, and shades of complementary colours is one that is used, perhaps unconsciously, for a very wide range of everyday arrangements. An example of the former would be a simple design of scarlet dahlias and strong green karaka leaves. A contrast is a design of the latter type with sprays of apple blossom in palest pink and white, offset by soft green apple leaves just unfurling. The former is pure complementary colour, and the latter is the pastel version of the same combination of colours, an arrangement in tints of red and green seen to the greatest advantage in a subdued setting. The orange-blue contrast already mentioned is very choice reduced to soft apricot-buff and delicate hyacinth blue.


Analogous

Complementary

Triad

Split-complementary

Masks used with the colour wheel are a quick and accurate check on colour schemes. It is best to cut them out of black cardboard.

Triad

Any three colours which form an equilateral triangle on the colour wheel may be used to form a triad. This is a combination which appears in nature, but it must be handled carefully in flower arrangement.

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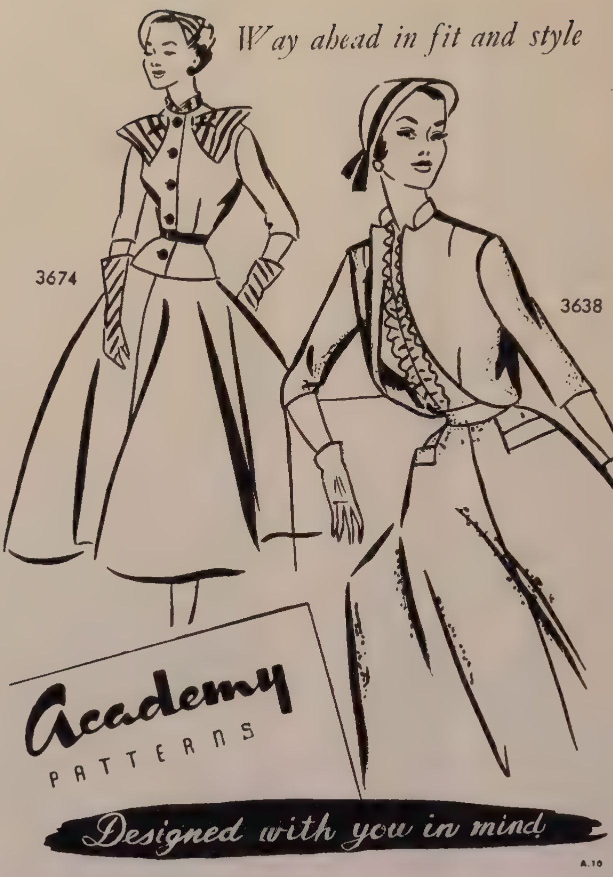
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Split Complementary

In a split complementary colour scheme one colour is used with the two hues that lie on either side of its direct complement or opposite. The key colour should be purest in value and the others more subdued. Plant materials are well suited to split complementary colour schemes.

Importance of Light

The effect of light colours must be considered. The less colour there is in an arrangement the stronger the light must be to display to advantage delicate tints, tones, and shades. A collection of dried material in browns, buffs, and fawns or foliage only in greens and white needs a plain, almost colourless background, with light from a window shining directly on it. If a pure analogous or complementary scheme is chosen for a striking effect, that effect will be heightened by strong light; on the other hand, an arrangement with colours a little too brilliant or hard for the surroundings can be toned down considerably by placing it out of the direct light in a corner or against darker drapings. There is only one exception to the rule that flowers should not be placed with light directly behind them, and that is with a sillow, made up of a very few strong lines, such as bare branches or vine tendrils, displayed in an elegantly shaped container against a high window, a stairway window for example. Within an arrangement colours which come dangerously near to a discord can be separated by a spray of green foliage or a group of white flowers, thereby softening the general effect sufficiently to allow the retaining of a bold colour scheme which is refreshing in its vigour and originality.

Colours which are disappointing at night are yellows, oranges, blues, purples, dark reds, and dark greens. Yellow becomes characterless and flat, blues are hard and cold, and dark reds, purples, and greens become darker and lifeless. As white always achieves the maximum effect under night light, white and tints of good night colours such as light, bright red, rose pink, medium pink, shell pink, and light lavenders are safe to use. The weaker the light is the paler are the tints of colour and the greater the number of white flowers required.

This rather old world arrangement massed in an antique container is semi-formal in outline. Placement of the colour closely follows the outline and emphasises the line of the design. From the top very pale pink rhododendrons descend on the left to carnations of a deeper pink and magnolias with purple-pink centres. A little lower on the right similar carnations and soft lavender buddleia continue the colour line down through two rhododendrons of deeper, brighter pink to spikes of heavy, purple-blue *Echium*, which form the focal point. This type of arrangement is sometimes referred to as "mass line".

Colour Psychology

Another important factor is colour psychology, the art of creating just the right atmosphere, so that the onlooker involuntarily reacts to it, murmuring "how lovely" or some other appreciative remark, probably without any very clear idea why the scene is so refreshing on a hot, weary day, or why another scene is so warm and cheerful on a cold day. In fact such effects depend largely on correct use of the descending or ascending colours on the colour wheel. The descending purples, violets, blues, blue-greens, and white suggestive of the colourings of glacial ice and snow holes produce the desired psychological reaction on a hot day. An example would be a room furnished in mauvy blues and dusky pinks, a very common combination, with flower arrangements in soft blues, pale lavender, soft blue-grey-greens, and white. The flower colours will accent the blues of the furnishings, causing them to stand out to quite a surprising extent, while the warmer pinks will sink into the background. Such a room brings refreshing relief in the heat of summer. In contrast the warm, cheery red always associated with an English Christmas scene shows the value of an ascending range of colours. With no alteration other than a change in flower colours the same room can be made to look cosy in winter by the use of tints, tones, and shades of red—probably several versions of pink—which will harmonise with the furnishings while subduing the blues and causing the warm pinks to predominate.

With these considerations in mind the value of the use of a colour wheel is evident, but use of the wheel does not mean that the artist sets to work on each flower piece chart in hand and a rigid set of colour rules in mind. A colour wheel is rather a guide and a very useful check, but it should in no way cramp individual expression and appreciation of the beauty of colour. Every arrangement need not necessarily fall into exact line with a recognised colour scheme, but where a particular effect is required it is a great help to know which colour scheme tends to that effect. Monochromatic, analogous, and complementary schemes are the three fundamental types, but there are others based on

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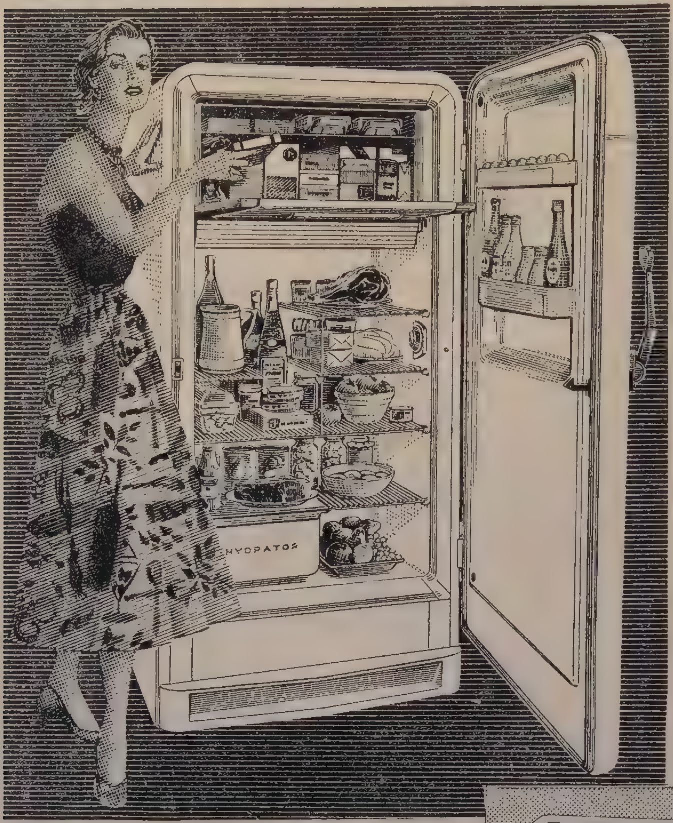

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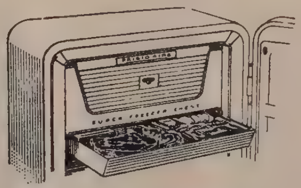

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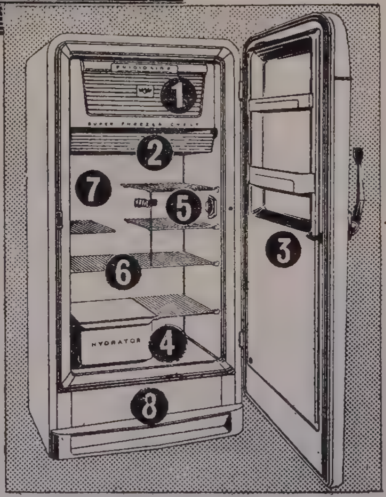

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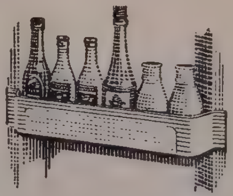

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Colour Design

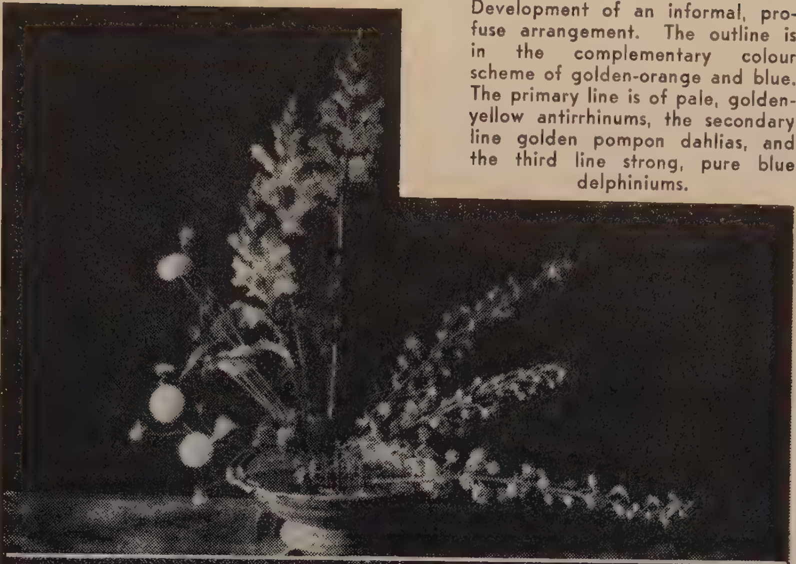
To the composition of flower arrangements—the design, scale, balance, and proportion of material available—can now be added design in colour. Repetition and rhythm are principles which are emphasised as colour is added to follow closely the strong lines of an already established design, care being taken that the dark colours and strong colours—those with more apparent, or "visual", weight—are always placed low in an arrangement to give balance, just as heavy material in low, wide lines provides balance for taller, lighter lines of height. It would be quite possible to work out a design in black and white—bare white branches and black berries, for instance, could be very attractive—but the addition of colour to such a design means added interest and rhythm, and probably a closer harmony with the surroundings. The contrast to good colour design is a distracting "spotty" effect. Red, white, and blue flowers mixed indiscriminately throughout an arrangement would be anything but restful to look at, whereas a high line in white, a strong group of blue swept up and out to emphasise the design, a focal point of red and darker blue, with just a touch of white out over the edge of the container would be more rhythmical and more restful. The small spray of white would be used with a white container. Similarly, if the container were blue, a small spray of blue flowers would serve to tie container and flower material together satisfactorily. In many cases the unity of the completed picture can be improved by the repetition of the colour of the container in flowers which break the hard line of its rim.

Colour in Mass Designs

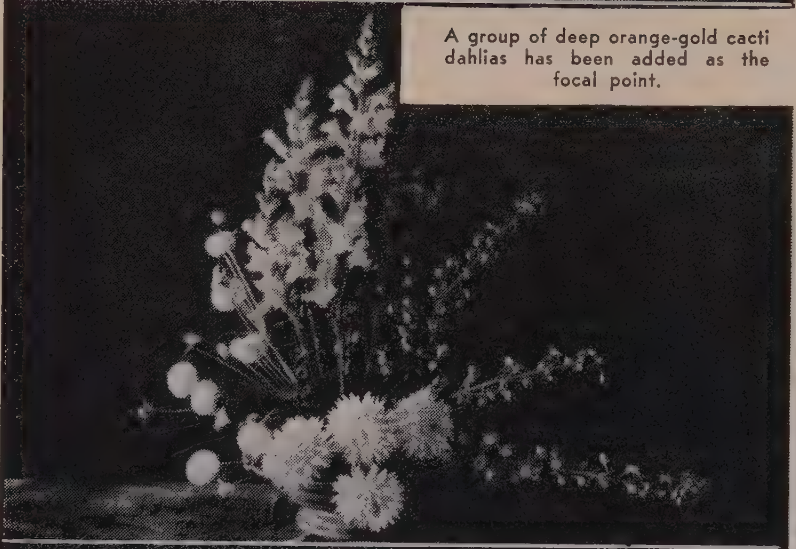
Mass designs depend almost entirely on their colour harmony, colour grouping, and colour design for effect; apart from these factors they have only an outline, with no apparent strong lines within the arrangement. In a flower piece with colours which are all pale and of much the same visual weight it is possible to achieve visual balance by massing some of the colour, or colours, at the base. The same rule applies to small flowers of a more intense colour value than large ones; in the same arrangement tall, pale snowdrops can well be balanced at the base with massed blue forget-me-nots. A bunch of violets often makes a delightful focal point for spring flowers in gold-yellow and violet-blue. A bunch of violets in the midst of dark violet-red roses is a joy to behold.

Thus colour can be introduced as an addition to good design in actual lines. Authorities differ as to whether design and colour should carry equal value in points when show pieces are being judged, or whether design should be placed slightly higher than colour. The latter valuation is now becoming more widely accepted in American shows, on the assumption that a design can be done in black and white, and that colour is only an addition to that design.

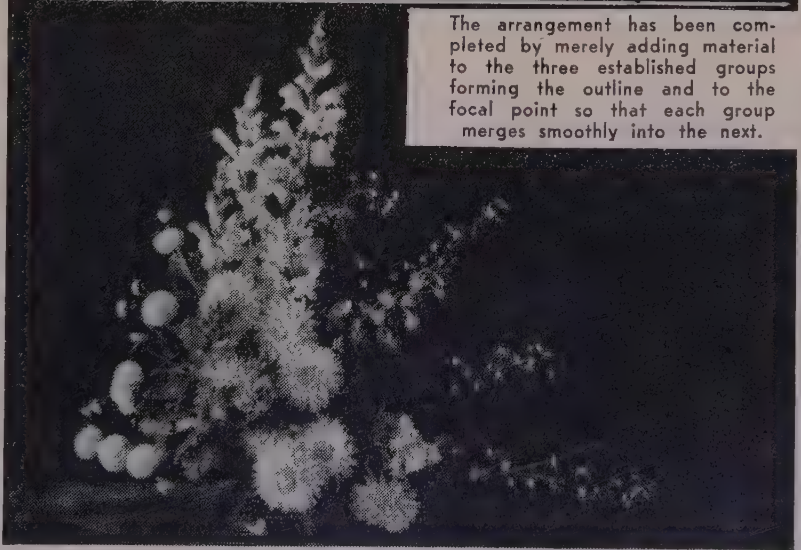
◆



Development of an informal, profuse arrangement. The outline is in the complementary colour scheme of golden-orange and blue. The primary line is of pale, golden-yellow antirrhinums, the secondary line golden pompon dahlias, and the third line strong, pure blue delphiniums.



A group of deep orange-gold cacti dahlias has been added as the focal point.



The arrangement has been completed by merely adding material to the three established groups forming the outline and to the focal point so that each group merges smoothly into the next.

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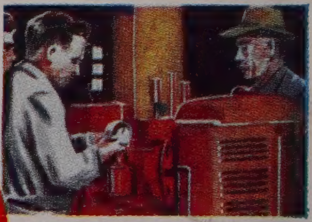

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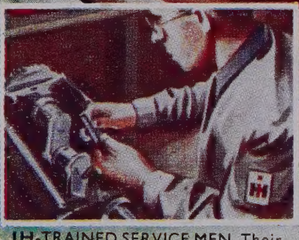

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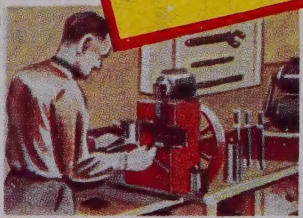

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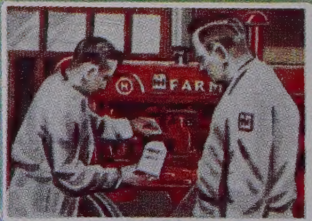

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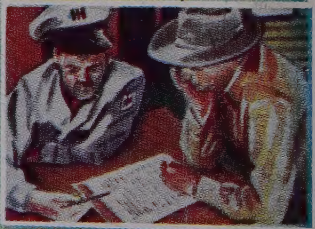

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